THE SCHOOLMASTERS MOST USEFUL COMPANION, AND SCHOLAR'S BEST INSTRUCTOR, IN THE Knowledge of ARITHMETIC.

IN TWO PARTS.

PART I.

Containing the first Principles of ARITHMETIC, with plain and concise Directions to Work the Rules of *Addition*, *Subtraction*, *Multiplication*, *Division*, *Reduction*, the *Rule* of *Three*, *Practice*, *Interest*, *Rebate* and *Discount*, *Fellowship* or *Partnership*, *Alligation*, *Progression*, *Vulgar* and *Decimal Fractions*, Extraction and Use of the *Square* and *Cube Roots*.

WITH A VARIETY OF

PRACTICAL QUESTIONS, to exercise the Scholar in all the foregoing Rules, each Question having the Answer inserted, in order to save the Master or Tutor a great deal of Time and Labour, and help the Scholar forward in his Progress in the practical Part of ARITHMETIC.

ALSO, RULES for performing CROSS MULTIPLICATION, with the Application to actual Practice in Measuring CARPENTERS, JOINERS, PAVIORS, THATCHERS, and BRICKLAYERS Work, and the Manner of gauging Coolers, Cisterns, and Casks in Wine, Ale Gallons, and Malt Bushels, both by the Pen and sliding Rule.

PART II.

Comprehending a Short and Simple SKETCH of BOOK-KEEPING, by way of COMMON DEBTOR and CREDITOR; by which ACCOMPTS may be kept with great Ease and Exactness.

The Whole digested in such a Manner as to render it not only useful in almost every Branch of Life and Business, but very Entertaining.

The THIRD EDITION, corrected, improved, and recommended by several of the most eminent Schoolmasters, and expert Arithmeticians in the Kingdom.

By D. FENNING,
Author of the ROYAL ENGLISH DICTIONARY, Young Man's BOOK of KNOWLEDGE, Young MEASURER's complete GUIDE, &c.

LONDON:
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MDCCLXXV.

PREFACE.

THE very favourable reception, which this work has met with in the two former editions, and for which I think myſelf highly indebted to the Public, may well ſeem to have rendered any alteration in the plan unneceſſary: Nevertheleſs, in conſequence of the advice of ſome of the moſt eminent ſchool-maſters and expert arithmeticians of the age, I have been induced to change, in ſome meaſure, the diſpoſition of the parts, and to make them ſucceed one another in a different order from what they did before. Theſe Alterations, together with ſome Additions, which I hope will be found to be real improvements, are as follow:

1. The ſigns and characters, uſed in Arithmetic, are placed at the beginning of the work, where they ought properly to ſtand.

2. The four ſimple rules of arithmetic, viz. ADDITION, SUBTRACTION, MULTIPLICATION, and DIVISION, are given twice in this edition, inſtead of once, as they were in the two former; that is, they are given firſt in whole numbers or integers, and afterwards in Numbers of different denominations; and to the laſt of theſe are prefixed the tables of money, weights, and meaſures, which is their moſt proper place, as the uſe of them is exemplified in the rules which immediately follow.

3. Reduction is preceded by ſome bills of parcels, adapted to real buſineſs, and is followed by the Single Rule of Three Direct, the Single Rule of Three Inverſe, the Double Rule of Three, Practice, &c. as any one may ſee by caſting his eyes over the contents, where he will likewiſe obſerve the other alterations that have been made in the arrangement of the ſections.

4. In Geometrical Progreſſion, an example is given of the method of ſolving queſtions by the *Indices*, or Numbers in Arithmetical Progreſſion, inſtead of thoſe in Geometrical Progreſſion; a thing that was omitted in the two former editions.

5. The Doctrine of Fractions, both Vulgar and Decimal, is thrown back towards the end of the book; for though the knowledge of the ſimpler parts of Fractions may ſeem requiſite to the ſolution of ſome queſtions in the foregoing rules, yet as the more abſtruſe branches of that ſcience are ſome of the moſt difficult parts of arithmetic, and as the whole muſt be exhibited in one connected view, it was thought better to place them towards the end than in the middle of the book, where they formerly ſtood. In effect, if Fractions muſt go before every rule, where the knowledge of them is neceſſary, they ought to precede ſimple Diviſion; for no perſon can perform an operation in that rule, where there is any remainder, without underſtanding Fractions, as the Quotient muſt, in that caſe, conſiſt of whole numbers, and a remainder divided by the Diviſor, which is a broken number, or real Fraction.

I have not however, in this, any more than in the two former editions, troubled either the maſter or ſcholar with examples of all the rules of Arithmetic in Fractions. I have given, indeed, the four firſt rules, together with Reduction, and the Rule of Three, both in Vulgar and Decimal Fractions. But as to Intereſt, Simple and Compound, and for Days, Rebate and Diſcount, Equation of Payments, &c. theſe I could not admit without overloading the work with what appeared to me to be ſuperfluous matter; for he that can perform theſe Rules in Integers, and is at the ſame time maſter of Fractions, can perform them

them with almoſt as much eaſe in Decimals as in whole Numbers.

For the ſame reaſon I have omitted, as I did formerly, all queſtions relating to Reverſions and Annuities, ſince theſe may likewiſe be ſolved by the Rule of Three, and, however wrapt up by ſome writers in an algebraic form, are in reality nothing more than particular inſtances of that comprehenſive rule. For in all ſuch queſtions, three things are given, to find a fourth; or perhaps five, to find a ſixth: and if the ſcholar attends properly to the terms of the queſtion, he can have no more difficulty in ſolving theſe than any other queſtion in the rule of Proportion. Let any one conſider the great variety of ways in which the ſame numbers may ſtand in proportion to one another, and of which he will ſee an example in page 69, and he will ſoon be convinced of the facility with which queſtions in Reverſions and Annuities, and all queſtions of a ſimilar nature, may be ſolved.

In place, therefore, of this uſeleſs and ſuperfluous matter, I have ſubſtituted a few plain directions for, and brief examples of Book-keeping; a branch of learning, which is greatly neglected, and yet is abſolutely neceſſary in almoſt every ſtation of life. I muſt likewiſe obſerve, that the Inſtructions in Menſuration, comprehending the Doctrine of Duodecimals, or Croſs Multiplication, which formerly appeared as an Appendix, are now thrown into the form of a Section, and make the laſt Section of the firſt part of the Book.

I have nothing further to add than to entreat the ſame indulgence to this, which was ſhewn to the two former editions, and to ſubſcribe myſelf the Reader's

Moſt obedient

and moſt obliged humble Servant,

D. FENNING.

ADVERTISEMENT from the EDITOR.

MR. FENNING having himſelf, as appears from his preface, prepared this edition of the following work, theEditor could have no farther concern in it than correcting the ſheets as they came from the preſs. This, however eaſy in the generality of publications, yet, in a work conſiſting almoſt entirely of figures, is a taſk attended with conſiderable difficulty. The miſtake of a letter, or even of a word, is eaſily perceived, and as eaſily corrected; but the miſtake of a figure cannot frequently be diſcovered without going through a long and tedious operation. Nor is it more difficult than important. The miſtake of a letter, or of a whole word, will not ſometimes materially alter the ſenſe; but the miſtake of a figure is ſure to vitiate the ſucceeding part of the operation, and to produce a reſult perhaps a hundred times more, or a hundred times leſs than it ought to be. The Editor, ſenſible of theſe truths, hath exerted his utmoſt attention to prevent any errors in the preſent work: but if, after all his care, a few ſhould have eſcaped him, the reader will be ſo good as to excuſe and correct them, and if he will tranſmit an account of them to the publiſher, that a proper uſe may be made of them in the next edition, it will be conſidered as an additional obligation.

RE-

RECOMMENDERS.

We, whoſe Names are hereunto ſubſcribed, beg Leave to recommend this little Treatiſe as the moſt uſeful Book of the Kind extant; the Rules being very plain and eaſy, and well adapted to Life and Buſineſs, it certainly will be a very great Help to the Scholar, and a good Aſſiſtant to the Tutor.

The Rev. Mr. Bernard,
The Rev. Mr. Chalmers.
The Rev. Mr. Cokayne, A. P. G.
The Rev. Mr. Duncome,
The Rev. Mr. Fiſke.
The Rev. Mr. Fontaine.
The Rev. Mr. Gilbie.
The Rev. Mr. Innis.
The Rev. Mr. Johnſon.
The Rev. Mr. Lee.
The Rev. Mr. Lepwell.
The Rev. Mr. Maſon.
The Rev. Mr. Pearce.
The Rev. Mr. Ryland.
The Rev. Mr. Turner.
The Rev. Dr. Watſon.

Mr. Bird, late Maſter of a School at Deptford.
Mr. Booth, Maſter of the Boarding School at Bromley.
Mr. Boyes, Maſter of the Boarding School at Alresford.
Mr. Cartwright, Maſter of the Boarding School at Bromley, near Bow.
Mr. Coulthiſt, Maſter of the Boarding School at Layton-Stone,
Mr. Deacon, Philom. in the Borough.
Mr. Earle, late Maſter of the Boarding School, at Deptford.
Mr. Edward Griffiths, Surveyor, Pantra Pant, near Oſweſtry, Shropſhire.
Mr. Ferguſſon, Maſter of the Academy near Hermitage-Street.
Mr. Fletcher, Writing Maſter Spital-Fields.
Mr. Goodier, Writing Maſter, in the Minories.
Mr. Girard, French Maſter, and private Tutor.
Mr. Gibbons, Writing Maſter at Plymouth.
Mr. Hart, Maſter of a Boarding-School at Margate.
Mr. Samuel Hill, College-Hill.
Mr. Hackman, late Maſter of a Boarding School at Watford.
Mr. Habgood, Maſter of the Boarding School, Newbury in Berks.
Mr. Leſlie, Writing Maſter, of Harlington in the County of Bedford.
Mr. Maples, Writing Maſter, Snow Hill.
Mr. Probert, Maſter of St. Mary le Bow Free School.
John Rule, A. M. Maſter of the Boarding School at Iſlington.
The Rev. Mr. John Ryland, Maſter of the Boarding School in the Town of Northampton.
Mr. Smith, School Maſter of Earls Colne.
Mr. William Thorley, Writing Maſter, Newcaſtle Street, White Chapel.
Mr. Sextie, Writing Maſter in Eaſt-lane, Rotherhithe.
Mr. Trinder, private Teacher to the Nobility and Gentry.

To Mr. Fenning, *on his School Master's Companion.*

SIR,

PUrsuant to your Request I have perused this little Treatise for the Use of Schools, and think it justly deserves the Name of *The Scholar's best Instructor*: I wish you great Success in the Publication, and am with Sincerity,

Sir, your humble Servant,

JOHN FERGUSSON.

Academy, New Hermitage Street, July 8, 1765.

SIR,

I Have perused the following Sheets, and highly approve of the Plan, and the Method of laying it down; particularly those Parts, concerning Mensuration and common Book-keeping, which are so well executed, that I think they cannot fail to be of great Service to all such who love to be improved in these Branches of Learning; and I heartily wish you may meet with that Encouragement which the Work deserves.

I am, Sir, your Friend and humble Servant,

JOHN PROBERT.

Bow Free-School, London, July 14, 1765.

SIR,

I Have perused this little Treatise, and recommend it to the Teacher and Pupil as a very useful one, and am persuaded the young Accomptant may find great Advantages from it.

Your Friend and well Wisher,

DAVID TOWNE.

Academy, Prescot-Street, Goodman's-Field's, July, 25, 1765.

CON-

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PART I.

PART II.

SIGNS

SIGNS *or* CHARACTERS *used in* ARITHMETICK.

THESE Signs or Characters are as follow:

I. (=) or two Lines drawn even one over the other, is the Sign of *Equality*, and ſhews that the Number or Numbers placed before it, are equal to the Number or Numbers after it: Thus 2 more 4 = 6, is read 2 added to 4 is *equal* to 6. And 12 more 15 = 27, that is 12 added to 15 is *equal* to 27.

2. This Character (+) is the Sign of *Addition*, and ſignifies *more*; it ſhews that the Numbers between which it is placed are to be added together: Thus 4 + 5 + 9 = 18 that is, 4, 5 and 9 added together are equal to 18: ſo 14 + 5 + 12 = 31.

3. This Character (—) is the Sign of *Subtraction*, and ſignifies *leſs*; it ſhews that the Number placed after it is to be taken out of, or ſubtracted from the Number before it: Thus 27 — 14 ſhews, that 14 is to be taken from 27: And alſo 12 + 4 — 7 = 9 ſhews, that when 7 is ſubtracted from the Sum of 12 and 4, there will remain 9.

4. This Character (×) is the Sign of *Multiplication* and ſignifies *into:* It ſhews that the Numbers between which it is placed are to be multiplied continually into each other: Thus, 4 × 6 is 4 into, or multiplied by 6. And 8 × 5 × 3 = 120, that is 8 *multiplied by* 5, and that Product again by 3, is equal to 120.

5. (÷) This Character is the Sign of *Diviſion*, and ſignifies *divided by*: it ſhews that the Number or Numbers before it are to be divided by the Number after it: Thus, 36 ÷ 4, ſhews that 36 is to be divided by 4: So alſo 72 ÷ 9 = 8: that is 72 divided by 9 is equal to 8. Again 192 ÷ 12 = 16.

6. Num-

6. Numbers placed thus ($\frac{5362}{51}$) like a Fraction, do likewiſe denote *Diviſion*; the upper Number being the *Dividend*, and the lower the *Diviſor*.

7. The reverſed Parentheſis)(denotes Diviſion alſo; as 3)6(2: that is 6 divided by 3 is equal to 2.

8. Four Points (::) ſet in the Middle of four Numbers, ſhew them to be proportional to one another; as 2 : 4 :: 6 : 12; that is, as 2 is to 4, ſo is 6 to 12.

9. This Mark ($\surd$) prefixed to any Number, ſignifies that the *Square-Root* of that Number is required.

10. This Mark ($\surd^3$) prefixed to any Number, ſignifies that the *Cube-Root* of that Number is required.

THE

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SCHOOL-MASTER's moſt uſeful Companion,

AND

SCHOLAR's Beſt INSTRUCTOR.

ARITHMETIC.

PART I.

INTRODUCTION.

Between a Tutor or Maſter, and his young Pupil, or Scholar.

Sch. *WHAT is* Arithmetic?

Maſt. Arithmetic is the Art of Numbering, or of performing Calculations by Numbers.

Sch. *How many Parts does* Arithmetic *contain?*

Maſt. Two Parts:--- One called *Whole Numbers*, the other named *Fractions*, which you will eaſily underſtand by the following Sections.

SECT. I.

Of NOTATION and NUMERATION.

Sch. *WHAT is the meaning of the Words* Notation *and* Numeration?

Maſt. Notation properly means the noting or writing down in Figures and Characters, any propoſed Number; and *Numeration*, the expreſſing by Words, Numbers already wrote down.

Sch. *How is* Notation *perform'd?*

Maſt. By the Help of nine Characters, called *Digits*, or *Figures*, which are theſe, *One* (1), *Two* (2), *Three* (3), *Four* (4), *Five* (5), *Six* (6), *Seven* (7), *Eight* (8), *Nine* (9), or thus, 1, 2, 3, 4, 5, 6, 7, 8, 9.

Sch. *Are theſe all the Figures uſed in ſetting down all Manner of Numbers?*

Maſt. They are all the numerical Characters, and by the Help of them and a Cypher (0), or Cyphers (0000, *&c.*) you may ſet down any Number, how large ſoever.

Sch. *Pray explain this.*

Maſt. I ſay, by adding or placing a Cypher (0), after any Figure, it makes its Value ten Times more than it was before: Thus 1 by adding a Cypher is *Ten* (10), or by adding two Cyphers it becomes a *Hundred* (100), or three Cyphers a *Thouſand* (1000), *&c.* as appears by the following

NUMERATION TABLE.

N. B. X ſtands for *Tens*, C for *Hundreds*, and every third Place of Figures is called *Hundreds* of a different Denomination.

TABLE I.

9	8	7	6	5	4	3	2	1	
								1	One or Unit
							1	0	Ten
						1	0	0	One Hundred
					1	0	0	0	One Thouſand
				1	0	0	0	0	X Thouſand
			1	0	0	0	0	0	One Hundred Thouſand
		1	0	0	0	0	0	0	One Million
	1	0	0	0	0	0	0	0	X Millions
1	0	0	0	0	0	0	0	0	One Hundred Millions

						Hundreds	Tens	Units
Cs of Millions	Xs of Millions	Millions	Cs of Thouſands	Xs of Thouſands	Thouſands			

TABLE II.

9 8 7 6 5 4. 3 2 1

Cs of Millions	Xs of Millions	Millions	Cs of Thousands	Xs of Thousands	Thousands	Hundreds	Tens	Units
							2	1
						3	3	3
					4	4	4	4
				5	5	5	5	5
			6	6	6	6	6	9
		7	7	7	7	7	7	7
	8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9	9

OBSERVATIONS.

1. The first of these two Tables appears very natural and easy at first Sight, every Place encreasing exactly 10 Times in Value towards the left Hand. The second Table, only by observing the Places of Hundreds and Thousands, *&c.* is also very easily understood.

2 You are to note, every third Figure is a Period or Place of 3 Figures, and is called Hundreds: Thus in Table II. the first 3 Figures (999) on the Right Hand in the lowest Line form the place of Hundreds, and are thus pronounced, *Units*, *Tens*, *Hundreds*, that is, Nine Hundred and Ninety Nine; the first three at the Top of the Right Hand perpendicular Line are 321, and pronounced Three Hundred and Twenty-One: The next Period contains three more Figures in the lowest Line, and forms the Place of Thousands, *viz.* 999,999, and are thus expressed, Nine Hundred, Ninety-Nine Thousand, nine Hundred and Ninety-Nine.—The six Figures at the Top of the perpendicular Line, 654,321, are expressed after the same Manner, *viz.* Six Hundred fifty four Thousand, three Hundred and twenty-one. The next three Figures in the lowest Line form the Place of Millions; they stand thus, 999,999,999, and are thus expressed, Nine Hundred

ninety-nine Millions, nine Hundred and ninety-nine Thouſand, nine Hundred and ninety-nine; and the Figures in the perpendicular Line, 987,654,321, are thus expreſſed, 9 Hundred, 87Million, 6 Hundred, 54 Thouſand, 3 Hundred, and 21. Thus by theſe Examples you may eaſily learn to number nine Figures, be they what they will.

Sch. I ſee it very plainly.

Maſt. *Very well; then pray, try to expreſs or write down in Words at length the following Numbers*, viz. 507; 4901; 61708; 497,640; and 209,704,503.

Sch. Theſe I can do very eaſily; but find it much more difficult to figure down any large Number myſelf, than it is to read it when already ſet down.

Maſt. That is very certain; but to aſſiſt you at firſt, —Write down upon your Slate as many Cyphers as there are Places in the propoſed Number, (i. e.) reckoning Units, one Place, or Cypher; Tens, two, or two Cyphers; Hundreds, three, *&c.* then beginning at the left, obſerve at each Place what ſignificant Figure is named, and, rubbing out the Cypher, write the ſignificant Figure in its Place; and ſo proceed through all the Cyphers you had ſet down. By this Means you may eaſily ſet down in Figures the following Numbers, *viz.* Seven Hundred.——One Thouſand, Seven Hundred and Sixty-three.———Twenty four Thouſand, five Hundred and Nine. ——— Six Hundred, Forty-ſeven Thouſand, Two Hundred, and Ninety-ſeven. — Three Million, Four Hundred and Five Thouſand, ſeven Hundred and Eighteen, *&c.*--- *Alſo ſet down in Figures the following Numbers, which you read of in Holy Scripture, viz.* Revelations, Chap. vii. One Hundred, forty-four Thouſand,-----and Iſaiah, Chap. xxvii. v. 36. One Hundred, fourſcore and five Thouſand.--- *After you have done theſe, try and ſet down*, Eleven Thouſand, Eleven Hundred, and Eleven.

Of Numbers expreſſed by Letters.

1---I
2---II As often as any Character is repeated, ſo many Times its Value is repeated.
3---III.

4---IV

4---IV A leſs Character before a greater, diminiſhes its Value.

5---V

6---VI A leſs Character after a greater increaſes its Value.

7---VII

8---VIII

9---IX

10---X

20---XX

40---XL

50---L

100---C

500---D or IↃ: every other Ↄ affixed increaſes this Number 10 Times.

1000---M or CIↃ: every other C and Ↄ (put one at each End,) encreaſe this Number 10 Times.

2000---MM

5000---IↃↃ or $\overline{\text{V}}$ A Line over any Number increaſes it 1000 fold.

1775---$\overline{\text{M}}$DCCLXXV

6000---$\overline{\text{V}}$I

10000---$\overline{\text{X}}$ or CCIↃↃ

50000---IↃↃↃ

60000---$\overline{\text{L}}\overline{\text{X}}$

100000---$\overline{\text{C}}$ or CCCIↃↃↃ

1000000---$\overline{\text{M}}$ or CCCCIↃↃↃↃ

2000000---$\overline{\text{MM}}$

SECT. II.

Of ADDITION.

Sch. *WHAT is* Addition?

Maſt. It is the adding together ſeveral Numbers into One, called their Sum, or Total.

Sch. *How many Sorts of* Addition *are there?*

Maſt. Two; *Simple* and *Compound*.

Sch. *What is* Simple Addition?

Maſt. Simple Addition is, when the ſeveral Numbers to

be added together are all of one Name; as all Yards, all Ells, all Gallons, Tons, Pounds, *&c.*

Sch. *How is this Sort of* Addition *performed?*

Maſt. By this one common Method, or

RULE.

1. Place the ſeveral Numbers to be added, underneath each other, ſo that the Figures of the ſame Name, with reſpect to Units, Tens, *&c.* may be ſtraight under each other.

2. Draw a Line under the loweſt Number, then add up the Column of Units, and conſider how many Tens are in the Sum, for which you muſt carry ſo many Ones to the next Column, writing down only the Exceſs over and above the Tens below the Line, ſtreight under its proper Column.

3. Add all the Columns in the ſame Manner, and the Figures below the Line will expreſs the Sum required.

There are ſeveral Methods uſed to prove Addition, but I think that working the Queſtion over again is as good as any,

EXAMPLES.

Ex. 1. *Yds.*	Ex. 2. *Ells.*	Ex. 3. *Pounds.*	Ex. 4. *Gallons.*
1	24	217	5415
2	47	194	4176
3	52	215	2345
4	10	419	5217
5	14	255	9463
6	51	947	1764
7	93	456	5472
8	15	147	1545
9	26	318	3421
45			

Ex.

Ex. 5. *Days.*	Ex. 6. *Hours.*	Ex. 7. *Years.*	Ex. 8. *Minutes.*
4729	3487	97417	97417
6421	3004	00595	595
7158	7110	00017	17
4947	2497	41715	41715
7538	1076	00005	5
4717	2470	02074	2074
8207	4791	00090	90
2045	9146	17005	17005

N. B. The 7th and 8th Examples are both alike; only the one has got Cyphers before the Figures, and the other has the Cyphers left out, as is much better.

Maſt. After you have caſt up theſe few Sums which I have ſet down ready for you, it will be greatly for your Improvement to place the Figures to be added in Order, yourſelf; for which Purpoſe I give you the following

EXAMPLES.

1. What is the Sum of 24, 637, 584, 639, 1427, and 3846?

2. Required the Sum of 3754, 1688, 71469, 318714, and 861759?

3. What is the Sum of 7184, 6071, 54926, 37184, and 3871654?

EXERCISES *in Addition.*

Queſtion 1. A Boy had 241 Marbles given him, and he won at Play 175 at one Time, and at another Time 53; at another Time 9; at another Time 650: and one of his former Companions, who had left off play, gave him 340; I demand how many he has in all?

Q. 2. A Perſon ſets out, and travels 8 Days, as follows; the firſt Day, 81 Miles; the ſecond, 105; the third, 57; the fourth, 89; the fifth, 18; the ſixth, 9; the 7th, he reſted; and on the eighth or laſt Day he went 243 Miles: How many Miles did he travel in all?

Q. 3. Suppoſe that from London to Hatfield is 20 Miles, from thence to Stilton 47 Miles, thence to Newark 48 Miles, thence to Doncaſter 37 Miles, thence

to

to Northallerton 62 Miles, thence to Durham 34 Miles, and from thence to Newcaſtle 15 Miles; how many Miles are there between London and Newcaſtle?

Q. 5. A Perſon dying, left to his Widow 1500 Pounds, to his eldeſt Son he left 30500, and to each of his other two Sons 3456; alſo 2700 to each of his two Daughters, beſides 751 Pounds in other ſmall Legacies; what did he die poſſeſſed of?

Maſt. Compound Addition, or Addition of different Denominations, will be explained afterwards.

SECT. III.

SUBTRACTION.

Sch. *WHAT is* Subtraction?

Maſt. Subtraction is the taking a *leſſer* Number out of a *greater*, or finding how much one Number exceeds another, and is juſt the Reverſe of *Addition*. The Number to be Subtracted is called the *Subtrahend*, that out of which it is to be taken is called the *Minuend*; and the Number remaining after one is taken out of the other, is named the *Difference*.

Sch. *How is* Subtraction *performed?*

Maſt. By the following

RULE.

1. Place the ſubtrahend under the minuend according to the directions given in addition, and draw a line below them.

2. Begin at the right, and ſubtract each under figure from that which ſtands above it, writing the remainder ſtreight under them below the line; ſo ſhall all the remainders together expreſs the difference required.

3. But when any figure exceeds that which is above it, conceive 10 to be added to the upper, and ſubtract the under from the ſum; but in this caſe, you muſt add 1 to the next under figure, before you ſubtract it.

To prove Subtraction,

Add the difference and ſubtrahend together, and the ſum will be equal to the minuend when the operation is right.

	Ex. 1.	Ex. 2.	Ex. 3.	Ex. 4.	Ex. 5.
From	9	17	45	427	4735
Take	5	9	23	215	1324
Difference	4	8	22		
Proof	9	17	45		

	Ex. 6.	Ex. 7.	Ex. 8.
From	49215	694765	6914945
Take	24105	412321	314925
Remainder			
Proof			

	Ex. 9.	Ex. 10.
From	2192463405	6917620019
Take	1040492002	4102101010
Remainder		
Proof		

Sch. *I underſtand you, Sir, very well. But how am I to ſubtract or take the lower Figure out of the Top one, when the lower Figure is larger than the Top?*

Maſt. Turn to the Rule again, and obſerve it well, and you will ſoon underſtand it. However I will give you an Example or two, and ſhew you.

Ex.

	Ex. 11.	Ex. 12.	Ex. 13.
From	4734*	9207	562417
Subtract	1547	1349	93345
Remain	3187		
Proof	4734		

* Here in Ex. 11. I find the Bottom Figure 7 cannot be ſubtracted out of the Top Figure 4; therefore I ſay, 7 from 4 I cannot have, but 7 from 10, (which remember is what you carry 1 for in whole Numbers,) there remains 3, and the Top Figure 4 added to it makes 7; then I carry 1 to the next lower Figure, which is 4, and it makes 5; but 5 from 3 I cannot, therefore I ſay 5 from 10 there remains 5, and 3 I take in is 8; or ſay 5 from 13 there remains 8; then I carry 1 to 5 is 6, which taken from 7, there remains 1 without borrowing; therefore I now carry Nothing, but only ſay 1 from 4 there remains 3; you may prove the Work as before, by adding the Remainder to the leſs Number.

Sch. *I thank you, Sir.*
Maſt. Here follow

More Examples.

From	401923	762195	176201987
Take	132405	263750	196042798
Remain			
Proof			

From	4219624635	7090416370
Subtract	271600797	34769183
Remain		
Proof		

Exam-

EXAMPLES where you are to place the Figures in order, one under another, yourſelf.

1. What is the Difference between 1735, and 8907?
2. How much does 30871, exceed 8907?
3. How much is 718402, leſs than 68714902?
4. Being to go a Journey of 393 Miles, at the End of 273 Miles my Horſe tired, and I went poſt the Remainder of my Journey; how many Miles had I to pay for?

SECT. IV.

MULTIPLICATION.

Sch. *WHAT is* Multiplication, *and what does it teach us?*

Maſt. Multiplication is inſtead of, or anſwers the End of many *Additions*; and therefore it teaches us to multiply one Number by another, and to tell the Product, Rectangle, or Content of ſuch Numbers. For ſuppoſe I was to add the Number 12, 7 Times together; I ſhould be obliged, by the Rule of *Addition*, to ſet the Number 12 ſeven Times one under the other; but in *Multiplication* I only ſay 7 Times 12 is 84, which is equal to 12 added 7 Times together.

Sch. *I underſtand you very well: But when one Number is to be multiplied by another, is there any Name given to both or either of them?*

Maſt. Yes, the Number that ſtands at Top, or that is to be multiplied, is called the *Multiplicand*; and the other Number placed below, or what you multiply by, is called the *Multiplier*; and the Product of theſe two is called the Anſwer.

Sch. *I underſtand this very well; But how am I to carry the Product of two Numbers readily from Figure to Figure.*

Maſt. You muſt learn the following Table perfectly by Heart, at Leiſure, and then you will very readily multiply any Numbers; for *Multiplication* is allowed to be the eaſieſt of all the firſt 4 Rules.

MUL-

MULTIPLICATION TABLE.

Once 1 is 1			
Twice 2	is	4	
3		6	
4		8	
5		10	
6		12	
		14	
		16	
		18	

4 Times 4	is	16
5		20
6		24
7		28
8		32
9		36

3 Times 3	is	9
4		12
		15
		18
6		21
8		24
9		27

5 Times 5	is	25
6		30
7		35
8		40
9		45

6 Times 6	is	36
7		42
8		48
9		54

7 Times 7	is	49
8		56
9		63

8 Times 8	is	64
9		72

9 Times 9—is— 81
10 Times 10—is—100
11 Times 11—is—121
12—is—132
12 Times 12—is—144

A TABLE *of* TWELVES.

12 Times 1	is	12
2		24
3		36
4		48
5		60
6		72
7		84
8		96
9		108
10		120
11		132
12		144

Note 1.

When you multiply, you carry One for every Ten to the next Figure, from the Unit's Place to the Tens, Hundreds, *&c.* as you did in *Addition.*

EXAM.

EXAMPLES.

Multiplicands	6	9	8	9
Multipliers	3	5	4	8
Products or Anſwers	18			

Multiply	23	47	56	87
By	3	by 5	by 7	by 6

Multiply	42716	57629	4072156
By	4	by 5	by 7

Multiply 4276583, by 9. *Anſ.* 38489247.
Multiply 49007567, by 10. *Anſ.* 490075670.

N. B. When you multiply by 10, or by 100, or by 1000, you may ſet down the very ſame Figures as are in the Multiplicand, only adding as many Cyphers to it as there are Cyphers in the Multiplier. Thus, if the laſt Example were multiplied by 100, then the Anſwer would have 1 Cypher more, *viz.* 490075670o; if it were multiplied by 1000, it would be 49007567000.

Multiply 5716929 by 11. *Anſ.* 62886219.
Multiply 45900765 by 12. *Anſ.* 550809180.
Multiply 947098998 by 12. *Anſ.* 11365187976.

Of double Figures, &c.

Multiply	24*	187	476	and 1364
By	15	by 43	by 67	by 85
	120			
	24			
Anſ.	360			

Note 2.

* Here in the firſt of theſe Examples, I firſt multiply 24 by 5 only, and the Product is 120; then I multiply 24 by 1, and ſet the 4 one Figure or Place forward: that

that is under the 2, and the 2 I ſet one Place forward, *viz.* under the 1; I then add theſe two Products together, according to the Laws or Rules of Addition, and find the Sum 360: therefore I ſay, 24 multiplied by 15 produces 360.

More EXAMPLES.

Multiply 49267 by 73. *Anſ.* 3596491.
Multiply 952470 by 89. *Anſ.* 84769830.
Multiply 929609 by 987. *Anſ.* 917524083.

Note 3.

When there are 3, 4, 5, or more Figures in the Multiplier, you are ſtill to begin with the 1ſt Figure as before; then multiply by the 2d Figure of the Multiplier, and ſet down the firſt Figure of the Product one Place more to the left Hand, *viz.* under the Tens of the Multiplicand; and having finiſhed the ſecond Line or Row, then proceed to multiply by the 3d Figure, and place the 1ſt Figure of this Product ſtill one Place more to the left. Thus do with the 4th Figure, ſetting the firſt Figure of its Product one Place ſtill further to the left, *viz.* in the Place of Thouſands; and thus proceed, placing the firſt Figure of every Product one Place more towards the left Hand till you have done all the Figures in the Multiplier—Then add all theſe Products together as in common Addition.—See the Firſt of the following Examples.

EXAMPLES.

Multiply	3491706	87142964
by	2453	8395
	10475118	
	17458530	
	13966824	
	6983412	
Anſ.	8565154818	Anſ. 731565182780

6
*3 X 5
0

4. *To prove Multiplication.*

*Firſt call all the Nines (9's) out of the Multiplicand; that is, add all the Figures together (except the 9's) ſaying

saying 3 and 4 is 7, and 1 is 8, and 7 is 15, and 6 is 21: then say, how many 9's in 21---*Answer* 2 9's and 3 over--- Set this 3 on the left Hand side of the Cross. 2dly, Then cast the 9's out of the Multiplier, saying 2 and 4 is 6, and 5 is 11 and 3 is 14; this is one 9 and 5 over---Set this 5 on the right Hand of the Cross.--- 3dly, Multiplying these 2 together, *viz.* 3 times 5, which is 15; this is one 9 and 6 over, which place at the Top.---Lastly, Cast the 9's out of the Product or Answer, and you will find that it contains 5 9's and 6 over, set this 6 below the Cross under the other 6; Thus I conclude the Work is right, because the Top Figure in the Cross is a 6, and the Bottom one is also 6; for you must note the top and bottom Figures must be both alike, otherwise the Work is wrong.

N. B. This is not an infallable Way to prove the Work, for it will prove right oftentimes when the Work is wrong; but it will never prove wrong when the Work is right— Division then is the true Way to prove *Multiplication*.

5 *Questions for Exercise.*

1. Multiply 57325, by 6473. *Ans.* 371064725.
2. Multiply 3079624, by 7356. *Ans.* 22653714144.
3. Multiply 4972098, by 59876. *Ans.* 297709339848.
4. Multiply 69417659, by 36947. *Ans.* 2564774247073.
5. Multiply 987654321, by 123456789.
   Ans. 121932631112635269.
6. Multiply 999999999, by 999999999.
   Ans. 999999998000000001.

6. *Of Cyphers in the Multiplier, commonly called Compendiums.*

Rule. When there are Cyphers at the End of your Multiplier, bring them down, and set them in the first Line of the Operation: then multiply by the first significant Figure of your Multiplier, and place the Product on the left of, and in the same Line with the Cyphers. If Cyphers occur next in the Multiplier, bring them likewise down, and place them in the

second Line of the Operation; only take care to set them to the left as many more Places than usual as you brought down Cyphers in the first Line: then multiply by the next significant Figure in the Multiplier, and set down the Product as formerly. Proceed in the same manner with all the other Cyphers and significant Figures in the Multiplier, and the Work will be complete.

Sch. *But I wish, Sir, you would give me one Example at large?*

Mast. I will.

Multiply	472196071	6241960756
	2908007000	108090400
8	3305372497000	
1 X 8	377756856800	
	42497646390	
8	944392142	
	1373149479840497000	674696034900342400

7. *Exercises in Compendiums.*

1. Multiply 634745, by 830005. *Ans.* 526841523725
2. Multiply 50072900, by 37000070.
Ans. 1852700805103000

SECT. V.

Of DIVISION.

Sch. *WHAT do you mean by* Division?

Mast. The dividing of any Number into any Parts required.

Sch. *Please to tell me what it teaches more particularly?*

Mast. Division teaches us to divide one Number by another, in order to tell how many Times the less Number is contained in the greater.

Sch. *What are the Names of the different Parts in* Division, *or what does it contain?*

Mast.

Maſt. *Diviſion* contains, or is comprehended under four Parts, *viz.*

1ſt. The *Dividend*, which is the Sum or Number given to be divided.

2dly. The *Diviſor*, or the Sum or Number which you divide by.

3dly. The *Quotient* or *Anſwer*, which always ſhews into how many Parts the *Dividend* is divided; or how many Times the *Diviſor* is contained in the *Dividend*.

4thly. The *Remainder* which is always a fractional Part, and belongs alſo to the *Quotient* which will be more fully ſhewn and better underſtood hereafter.

EXAMPLES.

Ex. 1.	Ex. 2.	Ex. 3.
Dividend	Dividend	Dividend
Diviſor 3)15	Diviſor 6)24	Diviſor 9)63
Quotient or Anſ. 5	Anſ. 4	Anſ. 7
3	6	9
Proof 15	Proof 24	Proof 63

Here I ſay the 3's in 15 are 5 times; the 6's in 24 are 4 times, and the 9's in 63 are 7 times: And to prove it, I multiply the Quotient or Anſwer by the ſame Diviſor, and the Product is the ſame as the Dividend,

Sch. *I ſee the Manner of it, but I wiſh you would give me an Example with more Figures.*

Maſt. I will.

Divide	Divide
By 7)1342945	By 9)43625641
Anſ. 191849-2	Anſ. 4847293-4
7	9
Proof 1342945	Proof 43625641

Here I ſay the 7's in 1 I can't have; therefore I take 2 Figures, ſaying the 7's in 13 is 1, and 6 over, this 6 I carry to the 4, and placing it in my Mind before it, it make 64; then I ſay how many 7's can I have in 64, Anſwer 9 7's, and 1 over, which I carry, to or place before the next Figure 2, and it is 12, then the 7's in 12 is 1 and 5 over, which I carry to the 9, and it makes 59; then I ſay the 7's in 59 is 8 times and 3 over, which I carry to the 4 and it makes 34, now the 7's in 34 is 4 times and 6 over, which 6 I carry to the laſt Figure 5 and it makes 65; then I ſay the 7's in 65 is 9 times and 2 over, which 2, (as there are no more Figures in the Dividend) I place after the Anſwer thus -2: So that the Quotient or Anſwer is 191849-2.

To prove the Work.

I multiply the Anſwer 191849-2 by the Diviſor 7; thus 7 times 9 is 63, and 2 the Remainder is 65, 5 and I carry 6; then 7 times 4 is 28, and 6 is 34, 4 and I carry 3, &c.

MORE EXAMPLES.

Divide	Divide	Divide
By 9)4194064	By 11)420478	By 12(94307164
Anſ. 466007-1	Anſ. 38225-3	Anſ. 7858930-4

8)47006492

12)7149653

12)91842605

12)60993276457

12)987621907056

I deſire you to make yourſelf quite perfect in dividing by ſingle Figures; but more particularly by 12's in 1 Line as in the above Example, for though it is troubleſome at firſt, yet Induſtry and Reſolution will ſoon

ſoon conquer it, and then you will be prepared to divide by more Figures with great Eaſe.

Sch. *I will take Care, Sir, to be perfect in what you have recommended, and I don't doubt but I ſhall ſoon be Maſter of it; but I am afraid of long* Diviſion, *becauſe I have heard ſay that it is by much the moſt difficult Rule of the Four.*

Maſt. Pray be not diſcouraged; you will ſoon underſtand *that* as well as the others. To convince you that you may do ſo, I will now give you a few eaſy Examples.

Ex. 1.		Ex. 2.
Divide	Quotient or Anſ.	Divide
By 34)47394	(1393-32 over	427)1467469(3436 Anſ.
34	34	1281*
133	5574	1864
102	4182	1708*
319	47394 Proof	1566
306		1281*
134		2859
102		2562*
32 remains.		297* remains.

Proof by Addition 1467469

An Explanation of Example 1. *at large.*

I aſk how many Times 34 is contained in 47 and find 1, which I put in the Quotient; then I multiply 34 by 1, and ſet 34 under 47; then I ſubtract 34 out of 47, and there remains 13; then I bring down the next Figure (viz. 3) and ſet it after the 13, and it is 133; then I aſk how many Times 34 I can have in 133, and find it 3 Times, which I place in the Quotient alſo, and then I multiply the Diviſor 34 by 3, which is 102, and place it under 133, and ſubtract it therefrom, and find the Remainder 31; to this I bring down the next Dividend Figure (viz. 9) and it is 319; then I aſk how many

many Times 34 I can have in 319, and find it 9 Times, which I now place after the 3 in the Quotient, and then multiply 34 by 9, I find it 306, which I place under 319, and ſubtract it therefrom; the Remainder is 13, to which I bring down the laſt Dividend Figure, *viz*, 4, and it is 134; then I enquire how many Times 34, the Diviſor, is contained in 134, and find it 3 Times, which I alſo place in the Quotient after the 9; then I multiply 34, the Diviſor, by 3, and it is 102, which I ſubtract from 134, and there remains 32 at laſt. —Thus I find that 47394 divided by 34, produces in the Quotient or for Anſwer 1393 and 32 over, which in Fractions muſt be expreſſed thus, $1393\frac{32}{34}$, as you will ſee hereafter. Proceed in the ſame Manner with the ſecond Example, or any other ſuch like Sum.

NOTE 1.

To prove Diviſion *by* Multiplication.

Multiply the Diviſor by the Quotient or Anſwer, or the Quotient by the Diviſor, and take in the Remainder, and if this Product or Sum be equal to the Dividend, the Work is right, otherwiſe falſe, as in Example 1ſt.

Note 2. *To prove it by* Addition.

Add all the Subtrahends or ſecond Lines in the Operation, together with the Remainder, in the ſame Order in which they ſtand, and if the Sum be equal to the Dividend the Work is right: Thus in Example 2d, I add all the Subtrahends, or ſecond Lines in the Operation, together with the Remainder, marked with Stars (thus *) and find the Sum 1467469, which is right.

I confeſs I approve of this Method, becauſe it is not only ſhorter and eaſier, but it accuſtoms the Scholar to ſet his Figures under each other in due Order, which is not often done by Learners; but here they are bound to do it, otherwiſe the Work cannot be proved. Now *Try*, try any of the following Queſtions, and draw your Lines ſtrait, and then the Work will ſtand ſo

that

that you may prove it with great Eaſe, provided you have done the Operation right.

Tyro, *Sir, I will try them directly.*

More Examples.

Divide 2001049068, by 7638. *Anſ.* 261986.
Divide 35640569003, by 43859. *Anſ.* 812617.
Divide 14771653740, by 246145. *Anſ.* 60012.

Sch. *I perceive, Sir, that theſe Examples come out free from any Remainder; but ſuppoſe there ſhould be Remainders, how am I to know their Value?*

Maſt. You muſt then ſet the Remainder after the Quotient or Anſwer, and place the Diviſor under it. Thus ſuppoſe I divide 57 by 8, it will be 7 and 1 over, *viz.* $7\frac{1}{8}$, that is 7 and 1 eighth Part. But to demonſtrate it plainer to you; let us ſuppoſe 57 *l.* to be divided among 8 Men, then it is evident that the Share of each is 7 *l.* (which is 56) and ſtill 1 *l.* remains over, which is $\frac{1}{8}$ of a Pound. Now one eighth of a Pound is 2 *s.* 6 *d.* therefore each Man's Share 7 *l.* 2 *s.* 6 *d.* This will appear more plainly afterwards.

Sch. *Sir, I now underſtand you well.*

Maſt. Then I am ſatisfied, and from this Inſtance you will comprehend the Value of every Remainder, and be able to expreſs it in the Anſwer. Thus,

Divide 1246039592 by 4629. *Anſ.* 269181 $\frac{7\,4\,3}{4\,6\,2\,9}$
Divide 8255511930 by 8716. *Anſ.* 947167 $\frac{4\,3\,5\,8}{8\,7\,1\,6}$

which $\frac{4\,3\,5\,8}{8\,7\,1\,6}$ is equal to $\frac{1}{2}$, becauſe 4358 is juſt the Half of the Diviſor 8716. This will appear more evidently when we come to ſpeak of Fractions.

Examples *without Anſwers.*

Divide 97464597 by 675. *Anſ.*
Divide 19076476 by 4762. *Anſ.*
Divide 79070674976 by 40079. *Anſ.*

Of Cyphers or Compendiums,

Rule. Cut off as many Cyphers as you find in the Diviſor, and cut off the ſame Number of Cyphers or Figures

Figures in the Dividend, as you did Cyphers in the Diviſor, and divide by the whole Numbers as before. But the Figures cut off from the Dividend, muſt be annexed to the Remainder at laſt.

EXAMPLES.

Divide 9840000 by 10000. Here I cut off the 4 Cyphers in the *Diviſor*, thus 1|0000, and alſo the 4 Cyphers in the *Dividend* thus, 984|0000, and then I have only to divide by 1; therefore the Anſwer will be the ſame as the Dividend, *viz.* 984. So alſo if I divide 4764|500 by 9|000. *Anſ.* $529\frac{3500}{9000}$.

Divide 4218976000 by 9150000.

Anſ. $461\frac{8260000}{9150000}$ or $461\frac{826}{915}$

Divide 940071629500 by 57167000. *Anſ.*

Of Diviſion of Money.

Sch. *How is this performed?*

Maſt. The ſame as common *Diviſion*, only having due Regard to the Place of *Pounds*, *Shillings*, *Pence*, and *Farthings*, an Example or two will ſoon make it eaſy.

SECT. VI.

ADDITION of Different DENOMINATIONS.

Sch. *WHAT do you mean by* Addition *of* different Denominations?

Maſt. Addition of different Denominations is where all the Sums to be added are not of the ſame Kind, but of different Degrees of Value; as Pounds, Shillings, Pence; Pints, Quarts, Gallons, &c.

Sch. *How is this Rule perform'd?*

Maſt. Add together the firſt Row or Denomination on the right Hand, as in Integers: then divide the Sum by as many of the ſame Denomination as make one of the next greater: ſet down the Remainder under the Row added, and carry the Quotient to the next ſuperior Denomination. Follow the ſame Method with

with all the other Denominations till you come to the laſt, which add as in ſimple Addition.

Of ADDITION of MONEY.

Sch. *How is* Addition *of* Money *perform'd?*

Maſt. With very great Eaſe, by well obſerving the following Rules.

RULE.

1. Place the Numbers always under thoſe of the ſame Denomination, as Shillings under Shillings, Pence under Pence, *&c.* Then beginning with the loweſt,

For every 4 in the Farthings carry 1 to the Pence; for every 12 in the Pence carry 1 to the Shillings; and for every 20 in the Shillings carry 1 to the Pounds, and caſt them up by *Tens*.

CHARACTERS *uſed in* Addition *of* Money.

A *Farthing* is 1 Fourth of a Penny, marked thus ($\frac{1}{4}$) A *Halfpenny* is 2 Fourths, or 1 Half, and marked thus ($\frac{1}{2}$). And 3 *Farthings* is 3 Fourths of a Penny, marked thus ($\frac{3}{4}$)

N. B. The Figures (4), (12), (20), and (10), ſet over the Rows, ſhew how many you ſtop at, or what you do by in that Row: And (£) ſtands for Pounds, (*s*) for Shillings, and (*d*) for Pence.

EXAMPLES.

(10)(20)(12)	(10)(20)(12)	(10)(20)(12)	(10)(20)(12)
£. *s.* *d.*	£. *s.* *d.*	£. *s.* *d.*	£. *s.* *d.*
4 9 6	17 14 9	147 17 6	9045 11 8$\frac{1}{4}$
3 4 2	14 11 6	215 14 9	4176 17 6
9 5 3	47 10 8	402 11 7	2196 14 9$\frac{1}{2}$
2 7 4	25 15 7	176 15 11	3090 17 1$\frac{3}{4}$
19 6 3			

But for the greater Eaſe of the Learner, it will be neceſſary that he commit to Memory the following Tables.

Pence

Pence Table.

Pence		*s.*	*d.*	*Pence*		*s.*
20	is	1	8	24	is	2
30	is	2	6	36	is	3
40	is	3	4	48	is	4
50	is	4	2	60	is	5
60	is	5	0	72	is	6
70	is	5	10	84	is	7
80	is	6	8	96	is	8
90	is	7	6	108	is	9
100	is	8	4	120	is	10

Table of Shillings.

s.		*l.*	*s.*
20	is	1	0
30	is	1	10
40	is	2	0
50	is	2	10
60	is	3	0
70	is	3	10
80	is	4	0
90	is	4	10
100	is	5	0

EXAMPLES.

(10)(20)(12)		
£.	*s.*	*d.*
484	7	$10\frac{1}{4}$
196	11	9
257	13	$7\frac{1}{2}$
146	19	4
904	11	$7\frac{1}{4}$
546	8	5
194	12	$3\frac{3}{4}$
718	10	11
472	11	$9\frac{1}{2}$
583	17	4
4506	4	$11\frac{1}{4}$

(10)(20)(12)		
£.	*s.*	*d.*
976	14	$11\frac{1}{4}$
137	19	$2\frac{1}{2}$
254	10	$6\frac{1}{4}$
155	4	$9\frac{3}{4}$
349	11	$7\frac{1}{4}$
125	19	$4\frac{1}{2}$
226	4	$9\frac{1}{2}$
257	11	$7\frac{3}{4}$
195	14	$10\frac{3}{4}$
219	15	$9\frac{1}{2}$

(10)(20)(12)		
£.	*s.*	*d.*
4717	14	8
1295	14	$10\frac{1}{4}$
9241	17	4
6417	11	$8\frac{3}{4}$
1904	17	2
2007	5	$9\frac{1}{2}$
1763	12	7
3480	4	8
1784	11	$6\frac{1}{4}$
8297	16	$9\frac{3}{4}$

Note 1. In these last Examples, and in every long Sum where the Pence and Shillings amount to a large Number, I would advise to stop at every 60 in the Place of Pence, and carry 5 Shillings for every such Dot or Period to the Place of Shillings; and also to stop at every 60 in the Place of Shillings, carrying 3 for every such Dot or Stop in the Shillings to the Place of Pounds.

EXCERCISES in Money.

Quest. 1. A lent B at four several Times as follows; 28*l.* 14*s.* 6*d.*; 15*l.* 11*s.* 9*d.* $\frac{1}{2}$; 190*l.* 10*s.* 9*d.* $\frac{3}{4}$; and a Bank Note of 50*l.* What does the Whole amount to? Or what does B owe to A in all? *Quest.*

Q. 2. A Gentleman ſent his Houſekeeper to Market, and ſhe laid out for Beef 13*s.* 4*d.* ½, for Greens 9*d.* ½, for Fiſh 7*s.* 8*d.* for Poultry 17*s.* 9*d.* ¾, and for Butter and Eggs 3*s.* 11*d.* What did ſhe lay out in all?

Q. 3. A Corn-factor pays for Wheat 37*l.* 15*s.* 8*d.* for Rye 11*l.* 16*s.* 3*d.* for Oats, 96*l.* 7*d.* ½, for Barley 53*l.* 12*s.* alſo for Peas and Beans 10*l.* He has alſo paid for Carriage and other petty Charges 3*l.* 17*s.* 5*d.* ¾, and for Inſurance 11*l.* 3*d.* ¾; now ſuppoſe that his Commiſſion on the whole is 7*l.* 3*s.* 0*d.* ½ for how much muſt he draw upon his Employer to clear the Account?

231*l.* 5*s.* 4*d.* ¼.

A Nobleman going out of Town, is informed by his Steward that his Butcher's Bill comes to 197*l.* 13*s.* 7*d.* ½, his Baker's to 59*l.* 5*s.* 2*d.* ¾, his Brewer's to 85*l.* his Wine-Merchant's to 103*l.* 13*s.* to his Lordſhip's Corn-chandler, is Due, 75*l.* 3*d.* to his Tallow-chandler and Cheeſe-monger 27*l.* 15*s.* 11*d.* ¼. and to his Taylor 55*l.* 3*s.* 5*d.* ¾, alſo for Rent, Servants Wages, and other Charges 127*l.* 3*s.* Now ſuppoſing he would take 100*l.* with him to defray his Expences on the Road, for what Sum muſt he ſend to his Banker?

830*l.* 14*s.* 6*d.* ¼.

Of COINS now or lately uſed in ENGLAND.

	l.	*s.*	*d.*
A Guinea is	1	1	0
Half a Guinea	0	10	6
A Moidore	1	7	0
Half a Moidore	0	13	6
A Port	1	16	0
Half a Port	0	18	0
A double Port	3	12	0

N. B. A Moidore has the Number 4000 upon it; Half a Moidore 2000; a Quarter of a Moidore, or 6*s.* 9*d.* has 1000 upon it.—— Thus may the Value of this Coin be known; a 5 Moidore Piece is 5 times 4000, viz. 20000, Value 5 Times 1*l.* 7*s.* or 6*l.* 15*s.*

A practical Question.

Ex. 3. A Person commits the following Money to my Care, *viz.* 3 Moidores; 47 Guineas; 5 Ports; 3 Half Ports; 1 Half Moidore; and 7*s.* and 3*d.* $\frac{1}{2}$ in Silver and Halfpence. How much does all this amount to?

Answer. 66*l.* 2*s.* 9*d.* $\frac{1}{2}$,

I. Of AVOIRDUPOISE WEIGHT.

Sch. *What is the Use of Avoirdupoise Weight?*

Mast. It is used in weighing all heavy and coarse Commodities, such as *Hops*, *Iron*, *Nails*, *Grocery*, *Chandlery Wares*, and almost every Thing, except Gold, Silver, and a few other Articles.

Sch. *What are the different Divisions of this Weight?*

Mast. Tons, Hundreds, Quarters, Pounds, Ounces, and Drams, as in the following Table.

16 Drams (drm. or 3) make an Ounce,
16 Ounces (oz.) make a Pound,
28 Pounds (lb.) 1 Quarter of a Hundred Weight,
4 Quarters (qrs.) 1 Hundred Weight, or 112 lb. c,
20 Hundred Weight (cwt.) 1 Ton.

Examples.

(10) T.	(20) C.	(4) qr.	(28) lb.
24	14	2	11
49	10	1	17
23	11	2	15
41	5	1	11
17	2	3	15
25	14	1	13
181	19	0	26

(10) C.	(4) qr.	(28) lb.	(16) oz.
17	2	17	11
41	3	15	10
29	1	17	15
47	2	14	5
67	1	23	2
15	3	11	10

(10) qr.	(28) lb.	(16) oz.	(16) drm.
17	14	11	12
25	17	10	14
19	27	6	13
47	15	13	10
56	11	4	11
17	5	9	14

A prac-

A practical Queſtion.

A Hop Merchant bought 5 Bags of Hops, weighing as follows; (No. 1.) 4 cwt. 1 qr. 21. lb. (No. 2.) 2 cwt. 3qr. 10 lb. (No. 3.) 3 cwt. 2 qr. 17 lb. (No. 4.) 3 qr. 27 lb. (No. 5.) 1 cwt. 3 qr. I demand what the whole weighs?

Anſwer, 13 cwt. 2qr. 19lb.

II. Of TROY WEIGHT.

Sch. *What is the chief Uſe of this Weight?*

Maſt. It is uſed in weighing all Liquids and ſome particular Things, ſuch as Gold, Silver, Jewels, Apothecaries Drugs, *&c.*

Sch. *What are the Denominations of this Weight?*

Maſt. Pounds, Ounces, Pennyweights, Grains, and Carrats, as follows in the

TABLE.

24 Grains (gr.) make a Pennyweight.
20 Pennyweights (dwts.) an Ounce.
12 Ounces (oz.) a lb.

N. B. A Carrat is no certain Weight, but is the 24th Part of any indifferent Quantity.—— Thus 22 Parts or Carrats of fine Gold, mixed with 2 Carrats of good Copper, is the Standard for Engliſh Gold Coin; and 11 oz. 2 dwts. of fine Silver, and 18 dwts. of good Copper, melted, is called true Sterling Silver.

(10) lb.	(12) oz.	(20) dwts.
41	11	17
27	9	11
45	4	9
17	5	2
19	10	18
27	9	15
180	3	12

(10) lb.	12) oz.	(20) dwts.
97	11	15
16	10	17
49	9	15
56	4	9
72	7	4
81	11	18

(10) lb.	(12) oz.	(20) dwts.	(24) gr.
47	10	17	21
94	3	15	17
72	5	17	23
27	6	15	11
61	11	10	9
15	7	15	15

A practical Question.

Bought of a Silverſmith as follows, 6 Tea-ſpoons, weighing 2 oz. 10 dwts. 15 gr. 6 large Spoons, 2 lb. 3oz. 17 dwts. 1 Pint Saucepan, 9 oz. 9 dwts. 12 gr. 1 Pint Mug, 11 oz. 17 dwts. and a Cream Pot, 3 oz. 14 dwts. 15 gr. How much do all weigh?

Anſwer. 4 lb. 7 oz. 8 dwts. 18 grs.

Sch. *I thank you, Sir, but pray what is the Difference between* Avoirdupoiſe *and* Troy Weight?

Maſt. You are to remember that 1 lb. Avoirdupoiſe is equal to 14 oz. 11 dwts. $15\frac{1}{2}$ gr. Troy; and 1 lb. Troy is equal to 13 oz. $2\frac{1}{2}$ drms. $\frac{23}{193}$ Avoirdupoize.

III. CHYMISTS *or* APOTHECARIES WEIGHT.

Sch. *What are the principal Denominations and Characters of this Weight?*

Maſt. They will appear by the following

TABLE.

20 Grains (gr.) make a Scruple (℈),
3 Scruples 1 Dram (ʒ),
8 Drams 1 Ounce (℥),
12 Ounces 1 Pound (℔),

There is no Occaſion for any long Examples in this Rule, it being ſo ſeldom required in Practice but by the Profeſſion itſelf: However, I ſhall give one Example.

A practical Queſtion.

A Chymiſt or Apothecary mixes 2ʒ 5℥ of Syrup with 3ʒ 4℥ 3ʒ of rectified Spirits of Wine; and alſo 5℥ 2℈ 15 gr. of the Bark with 4ʒ 3ʒ 1℈ 8 gr. of Mint Water. How much do all theſe weigh?

Anſwer. 11 oz. 2ʒ 1℈ 3 gr.

IV. *Of* DRY MEASURE.

Sch. *What is* Dry Meaſure?

Maſt. It is that by which almoſt all dry Goods are meaſured, ſuch as Wheat, Barley, Rye, Oats, Beans, Peas,

Peas, Coal, Seed, and other Grain; and alſo Sea Coal and Small Coal.

Sch. *What are the different Diviſions of this Meaſure?*

Maſt. You will ſee by the following Tables.

TABLE I. *Corn Meaſure.*

2 Pints	make	1 Quart.
2 Quarts		1 Pottle or ½ Gallon.
2 Pottles or 4 Quarts		1 Gallon
2 Gallons		1 Peck.
4 Pecks		1 Buſhel.
4 Buſhels		1 Coome.
2 Coomes		1 Seam or Quarter.
5 Quarters or 40 Buſhels		1 Load.
2 Loads		1 Wey.

TABLE II. *Coal Meaſure.*

4 Pecks	1 Buſhel.
3 Buſhels	1 Sack.
12 Sacks or 36 Buſhels	1 Chaldron.

Note 1. That 5 Buſhels make a Sack of Flour, and in Bran you have double Meaſure, that is, 2 Buſhels for 1.

Note 2. In Coal Meaſure there is an Allowance of 1 Chaldron in 20, that is, he that buys 20 Chaldron has 21.

V. *Of* LIQUID MEASURE.

Sch. *What do you call* Liquid Meaſure?

Maſt. That Standard by which all Liquids, ſuch as Beer, Wine, Rum, Brandy, Spirits, Strong Waters, Cyder, Perry, Vinegar, Oils, *&c.* are meaſured.

Sch. Are there not 2 Sorts of Liquid Meaſure?

Maſt. Yes, one is called *Beer Meaſure*, or *Wincheſter Meaſure*; the other is called *Wine Meaſure*.

Sch. *Pray what is their Difference?*

Maſt. It will appear from the following Tables.

I. *Beer and Ale Measure.*

TABLE.

2 Pints	make	1 Quart.
4 Quarts		1 Gallon.
8 Gallons		1 Firkin of Ale.
9 Gallons		1 Firkin of Beer.
2 Firkins		1 Kilderkin or ½ a Barrel.
2 Kilderkins		1 Barrel of 36 Gallons.
1 ½ Barrel or 54 Gallons		1 Hogshead.
2 Hogsheads		1 Butt.

N. B. That in *London*, according to the Excise-Rule, 32 Gallons make a Barrel of Ale, and 36 a Barrel of Beer; but in all other Parts of *England* the Excise reckons 34 Gallons to a Barrel, both of Ale, and of Strong Beer, and Small.

II. *Of Wine Measure.*

TABLE.

2 Pints	make	1 Quart.
4 Quarts		1 Gallon.
10 Gallons		1 Anchor of Brandy or spirituous Liquors.
18 Gallons		1 Runlet.
42 Gallons		1 Tierce.
63 Gallons		1 Hogshead.
84 Gallons (or any Measure from 36 to 100)		1 Puncheon.
2 Hogsheads or 126 Gallons		1 Pipe.
2 Pipes		1 Tun.

(10) Butts.	(2) hds.	(1½) bar.	(2) kil.	(2) fir.	(9) gal.
47	1	1	1	0	5
29	1	0	0	1	4
14	1	1	0	0	6
16	1	0	1	1	5
17	1	1	0	1	2
15	1	1	1	0	7
143	0	1	0	0	2

(10) Beer bar.	(2) kil.	(18) gal.
645	1	16
179	0	14
915	1	10
476	0	15
127	1	17
649	1	11

VI. Of CLOTH MEASURE.

Sch. *What are the Divisions of* Cloth Measure?
Mast. They are as follow:

TABLE.

4 Nails make a Quarter of a Yard.
3 Nails make a Quarter of an Ell Flemish.
5 Nails a Quarter of an Ell English.
N. B. An Ell English is 1 Yard 1 Quarter.

EXAMPLES.

(10) yds.	(4) qrs.	(4) nls.	(10) ells E.	(4) qrs.	(5) nls.	(10) ells F.	(4) qrs.	(3) nls.
41	3	2	47	2	4	42	2	1
24	2	3	19	3	2	17	1	2
92	1	1	41	1	3	47	2	1
68	3	1	17	2	1	19	1	2
17	1	3	16	1	4	27	2	1
21	2	2	17	2	1	19	2	1
266	3	0						

VII. Of LONG MEASURE.

Sch. *What are the Denominations of this Measure?*
Mast. They are as follow:

TABLE.

3 Barley Corns — make — 1 Inch.
12 Inches — — 1 Foot.
3 Feet — — 1 Yard.
5 ½ Yards — — — 1 Rod or Pole.
40 Rods or Poles — — 1 Furlong.
8 Furlongs — — 1 Mile.
3 Miles — — — 1 League.
20 Leagues — — 1 Degree of a circle
360 Degrees make a whole Circle, or the Circumference of the Globe of the Earth and Sea.

N. B.

N. B. 60 Miles is commonly called a Degree; but 69 and a Half Miles is a Degree in the Arch of any great Circle upon the Surface of the Earth.

EXAMPLE:

(10) Deg.	(20) leag.	(3) m.	(8) fur.	(40) rods.	(5½) yds.	(3) ft:	(12) inch.	(3) bar. cor.
241	17	2	5	27	2	2	10	2
176	11	1	2	15	1	1	11	1
204	14	1	3	31	1	0	9	2
176	9	1	2	14	1	1	5	1
317	4	1	3	21	0	2	11	2
215	15	2	7	15	3	1	4	1

VIII. SQUARE MEASURE.

Sch. *What are the Denominations of this Meaſure, and what is its Uſe?*

Maſt. It is uſed in meaſuring Boards, Glaſs, Land, and all kinds of Surfaces. Its Denomination may be ſeen in the following

TABLE.

16	ſquare Quarters	— make —	1	ſquare Inch.
144	Inches		1	Foot.
9	Feet		1	Yard.
30¼	Yards		1	Rod or Pole.
40	Poles		1	Rood.
4	Roods		1	Acre.
640	Acres		1	Mile.

EXAM-

EXAMPLES of *Land Meaſure.*

(10) Acres.	(4) roods.	(40) poles.	(10) Acres.	(4) roods.	(40) poles.
174	3	19	123	17	29
429	1	28	307	91	17
217	3	17	515	27	19
41	1	15	212	14	21
9	2	27	907	91	15
117	1	31	411	45	27
1363	2	17			

IX. Of TIME.

Sch. *What are the Diviſions of* Time?

Maſt. You will ſoon underſtand them by the following Table.

TABLE.

60 Seconds or Moments — make — 1 Minute.
60 Minutes - - - - 1 Hour.
24 Hours - - - - 1 Day.
7 Days - - - - 1 Week.
4 Weeks - - - 1 Month.
13 Months, or 52 Weeks, or 365 Days, 1 Year.

N. B. Every 4th Year is a Leap-Year, and that conſiſts of 366 Days.

(10) Yrs:	(13) M.	(4) W.	(7) D.	(24) H.	(10) Ds.	(24) H.	(60) M.	(60) S.
56	11	3	6	21	167	17	26	49
14	9	2	3	17	224	19	19	19
17	3	1	5	11	192	17	27	25
45	12	2	3	15	921	21	21	27
96	1	1	2	21	176	14	14	15
231	4	0	1	13				

Of THINGS neceſſary to be known in Buſineſs.

I. *Of* WEIGHTS *and* MEASURES.

A Barrel of Anchovies 30 lb.— A Barrel of Ale 32 Gallons, a Barrel of Beer 36 Gallons.— A Barrel of Figs

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317	4	1	3	21	0	2	11	2
215	15	2	7	15	3	1	4	1

VIII. SQUARE MEASURE.

Sch. *What are the Denominations of this Meaſure, and what is its Uſe?*

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56	11	3	6	21	167	17	26	49
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Figs from 100 to 300lb.— A Barrel of Gunpowder 112lb.— A Barrel of Herrings 500lb.— A Cade of Herrings 500 in Number.— A Cade of Sprats 1000.— A Clove of Cheese 8lb.— A Clove of Wool 7lb.— A Dicker of Leather 10 Skins.— A Fathom 6 Feet.— A Furlong 40 Rods or 220 Yards.— A Firkin of Butter 56lb.— A Firkin of Soap 64lb.— A Keg of Herrings 60.— A Last of Leather 24 Dickers.— A Last of Tar 14 Barrels.— A Last of Gunpowder 24 Barrels.— A Last of Corn 2 Loads.— A Load 5 Quarters or 40 Bushels.— A Load of Hay from 25 to 30 Hundred Weight.— A Load of Bricks 500.— A Load of Tiles 1000.— A Puncheon of Rum from 70 to 100 Gallons.— A Puncheon of Prunes 10 or 12 Cwt.— A Quintal of Fish from 100 to 112lb.— A Square of Tiling, Roofing, or Thatching 100 Feet Square, that is 10 Times 10.— A Stack of Wood 3 Feet in Heighth, 3 Feet deep, and 12 Feet long, which makes 108 cubic Feet.— A Ton is 20Cwt.— A Ton of Lead 19½ Hundred Weight. A Tun of Wine 252 Gallons.— A Tun of sweet Oil 236 Gallons.— A Truss of Hay from 50 to 60lb.— A Wey 5 Chaldron.— A Wey of Cheese in Suffolk is 256lb. in Essex 336lb.

II. Of PAPER, &c.

Twenty-four Sheets make a Quire, 20 Quires 1 Ream, 12 Reams 1 Bale.— 5 Dozen of Skins make a Roll of Parchment.— 110 Sheets in Books make, or are reckoned to, the Hundred.

III. Of GOLD, SILVER, &c.

One Grain of Gold is valued at 2 Pence.— 1 Penny-weight at 4s.— 1 Ounce at 4l.— A Pound 48l.— A Grain of Silver about ½ a Farthing.— A Penny-weight 3 Pence.— An Ounce 5s.— A Pound about 3l.

SECT.

SECT. VII.

SUBTRACTION of different DENOMINATIONS.

Sch. *WHAT is* Subtraction *of different* Denominations?

Maſt. Subtraction of different *Denominations* is where the Sums to be taken from each other are not all of the ſame Kind, but of different Degrees of Value; as Pounds, Shillings, Pence; Acres, Roods, Poles, &c.

Of MONEY.

This is performed the ſame Way as the whole Numbers, for if the lower Figure is greater than the Top one, then take the lower Figure out of what you do by, *viz.* 4 at Farthings, 12 at Pence, 20 at Shillings, Ten at Pounds, and add the top Figure to the Difference.

Note 1. When the lower Figures are leſs than the Top ones, only ſubtract or take the one from the other, and ſet down the Remainder in the Place of Farthings, Pence, Shillings, and Pounds.

EXAMPLES.

	(10) *l.*	(20) *s.*	(12) *d.*	(10) *l.*	(20) *s.*	(12) *d.*	(10) *l.*	(20) *s.*	(12) *d.*
From	9	7	6	46	17	11	647	14	9
Subtract	3	2	3	21	8	9	325	10	2
Remain	6	5	3*						
Proof	9	7	6						

* Here you ſee my young Scholar, that in the *firſt* of theſe Examples, I only ſubtract the ſecond Line or lower Sum out of the Top one, and there remains *6l. 5s. 3d.*— To prove this, I add the Remainder, or Anſwer, *6l. 5s. 3d.* to the leſs Sum, *3l. 2s. 3d.* ſaying 3 and 3 is 6; 5 and 2 makes 7; and 6 and 3 is 9.

More

More EXAMPLES.

	l.	s.	d.	l.	s.	d.	l.	s.	d.
From	423	5	9	647	14	6	6945	17	6
Take	121	3	6	134	9	3	1413	14	5
Remains	302	2	3						
Proof	423	5	9						

	(10) l	(20) s.	(12) d.	(4	(10) l.	(20) s.	(12) d.	(4	(10) l.	(20) s.	(12) d.	(4
From	476	17	4	½	494	13	7	¾	6470	14	6	½
Take	124	8	3	¾	160	12	5	¼	1460	9	5	½
Rema.	352	9	1	¼								
Proof	476	17	4	½								

	l.	s.	d.	l.	s.	d.	l.	s.	d.
From	9470	14	6¼	6004	12	6¼	7219	4	11½
Subtr.	1060	11	5	1003	9	2	117	3	9¼
Rema.	8410	3	1¼						
Proof	9470	14	6¼						

EXAMPLES *when the lower Figure is ſometimes greater than the Top one.*

Note 2. When the Farthings, Pence, or Shillings, in the Sum to be ſubtracted, are greater than thoſe in the top Sum, or what you are to ſubtract from, then take the lower Figure from what you do by, or ſtop at, *viz.* 4, 12, 20, and take in or add the top Figure to the Remainder, and carry the 1 you borrowed to the next Place.

	l.	s.	d.	l.	s.	d.	l.	s.	d.
From	47	10	7¼	671	14	6	975	11	7½
Take	18	12	8½	192	15	9	364	5	9¾
Remain	28	17	10¾						
Proof	47	10	7¼						

Here

* Here, in Example 1, you see that you cannot take a *Halfpenny* out of a *Farthing*; therefore I say, a Halfpenny or 2 Farthings from a Penny or 4 Farthings, (what you do by) there remain 2 Farthings, and 1 Farthing I take in besides from the top Line make 3 Farthings.— Then because I borrowed, I carry 1 to 8 in the Pence Place, which makes 9; now 9 Pence from seven I cannot take, but 9 Pence from 12 Pence (what I do by) there remain 3 Pence, and the 7 Pence at Top added to it make 10 Pence.— Then I carry 1 to the Shillings because I borrowed 12 in the Pence, and say 1 I carry to 12 makes 13; but 13*s.* from 10*s.* I cannot take, therefore I say 13 from 20 Shillings (what I do by) there remains 7, and the 10 Shillings on the top Line added make 17.— Then I carry 1 to 8 in the Pounds, which make 9, and say 9 from 7 I can't, but 9 from 17 there remains 8, then 1 I carry to 1 makes 2, which taken from 4 there remains 2.—— *Proof*, 3 Farthings and 2 make 5 Farthings, which is 1 Farthing above a Penny; carry 1 to 10 Pence is 11, and 8 Pence is 19 Pence, which is 7 Pence above 1 Shilling or 12 Pence.—Carry 1 to 17 Shillings is 18, and 12 make 30 Shillings, which is 10 above 20.— Then I carry 1 to 8 is 9, and 8 is 17, which is 7 above 10, and I carry 1 to 2 is 3 and 1 is 4.——— Thus, my dear Pupil, I have gone through the whole of the first Operation, by attending to which you may, with very little Trouble, perform all the other Operations in *Subtraction*.

MORE EXAMPLES.

	l.	*s.*	*d.*	*l.*	*s.*	*d.*	*l.*	*s.*	*d.*
From	476	14	$6\frac{1}{4}$	4570	2	6	670	10	$7\frac{3}{4}$
Take	198	7	$9\frac{3}{4}$	978	3	$9\frac{1}{2}$	129	10	9
Remains	278	6	$8\frac{1}{2}$						
Proof	476	14	$6\frac{1}{4}$						

Practical Queſtions for Buſineſs.

1. Maſter *Tommy Bountiful* lent Maſter *Billy Want* 2 Guineas; and *Billy* paid him at one Time 5*s.* 6*d.* at another Time Half a Guinea, at another Time 15*s.* I demand what remains ſtill due to Maſter *Tommy?*

Anſwer 11*s.*

2. A borrowed of B 100*l.* and paid at one Time 15 Guineas, at another Time 30 Guineas, at another Time 20*l.* and, by a Bank Bill, 25*l.* 5*s.* I demand what is the Ballance, or what is ſtill due from A to B?

Anſwer. 7*l.* 10*s.* due to B.

AVOIRDUPOISE WEIGHT.

	(10) Tons	(20) cwt.	(4) qr.	(28) lb.	(16) oz.
From	47	11	1	17	10
Take	19	17	1	14	12
Remains	27	14	0	2	14
Proof	47	11	1	17	10

	(10) Cwt.	(4) qr.	(28) lb.	(16) oz.	(16) dr.
From	671	2	17	10	8
Take	194	1	21	11	10

Note. This and all following Sums are done in the ſame Manner as Subtraction of Money; only always remember, that when the lower Figure is greater than the Top, take it out of what you do by, and then add the Top Figure beſides, and that is the true Remainder.——Then carry the 1 you borrowed to the next Denomination, and you will find the Operation ſoon done to your Satisfaction.

TROY WEIGHT.

	(10) lb.	(12) oz.	(20) dwts.	(24) gr.
From	47	3	17	16
Take	19	9	16	21
Remains	27	6	0	19
Proof	47	3	17	16

	(10) lb.	(12) oz.	(20) dwt.	(24) gr.
From	647	10	11	20
Take	192	11	9	23

DRY

DRY MEASURE.

	(10) Loads	(5) qrs.	(8) bush.	(4) pecks.	(10) Chal.	(36) bush.	(4) pecks.
From	64	2	5	2	1696	21	2
Take	17	3	3	3	947	27	3
Remain	46	4	1	3			
Proof	64	2	5	2			

LIQUID MEASURE.

I. *Beer Measure.*

	(10) Tuns	(2) bts.	(2) hhs.	(1½) bar	(2) kil.	(18) gall.	(10) Bar.	(36) gal.	(4) qu.
From	271	1	1	1	0	14	364	17	2
Take	169	0	1	0	1	16	176	25	3
Remain									
Proof									

II. *Wine Measure.*

	(10) Tuns	(2) pip.	(2) hh.	(63) gall.	(10) Hhd.	(63) gal.	(8) pint.
From	57	1	0	27	65	17	5
Take	19	0	1	15	19	51	6
Remain	38	0	1	12			
Proof	57	1	0	27			

CLOTH MEASURE.

	(10) (4) (4)			(10) (4) (5)			(10) (4) (3)		
	Yds.	qrs.	nls.	Ells E.	qrs.	nls.	Ells F.	qr.	nls.
From	65	3	2	274	2	3	351	2	1
Take	19	3	2	196	3	4	163	2	2
Remain	46	0	0						
Proof	65	3	2						

LONG MEASURE.

	(10)	(20)	(3)	(8)	(40)	($5\frac{1}{2}$)	(3)	(10)	(36)	(3)
	Deg.	leag.	m.	fur.	rods	yds.	ft.	Yds.	inch.	bc.
From	124	14.	2	4	23	2.	1	476	21	1
Take	19	17	1	5	27	1	2	191	27	2
Answer										
Proof										

LAND MEASURE.

	(10)	(4)	(40)	(10)	(4)	(40)
	Acres.	roods.	pls.	Acres.	roods.	pls.
From	194	2	27	647	2	31
Take	79	2	30	174	3	37
Answer	114	3	37			
Proof	194	2	27			

TIME.

	(10)	(13)	(4)	(7)	(10)	(7)	(24)	(60)	(60)
	Yrs.	M.	W.	D.	Wks.	D.	H.	M.	S.
From	47	7	2	4	164	2	17	41	27
Take	19	8	2	5	97	3	21	47	30
Anſwer	27	11	3	6					
Proof	47	7	2	4					

EXAMPLES to exerciſe the young Scholar in the Rules of ADDITION and SUBTRACTION.

1. A Perſon in the Year 1764, being aſked how long it was ſince *William* the *Conqueror* reigned, ſaid he could not immediately tell; but he remembered it was in the Year 1066. I demand how many Years it was ago?

Anſwer. 698 Years.

2. A Boy had 1000 Marbles: He ſold 290, he gave away 3 Score, and he loſt at Play 437. I demand how many he has left?

Anſwer. 213

3. Two Travellers, A and B, intending to meet, ſet out from two different Places, which lie diſtant from each other 327 Miles: A travels 21 Miles the firſt Day, 40 Miles the 2d Day, and 51 Miles the 3d Day. B travels the 2 firſt Days 40 Miles each, the 3d Day he travels 57 Miles, the 4th Day he goes 32 Miles. I demand how far A and B both travelled, and how many Miles they are ſtill diſtant from each other?

Anſwer. A travelled in all 112 Miles, B travelled in all 169, and they are ſtill diſtant 46 Miles.

4. A Houſekeeper received of her Maſter 2 Guineas and a half to go to Market: ſhe laid out for Fowls and Bacon 8*s.* 7*d.* ½, for Greens 4*d.* ½, for Beef 7*s.* 9*d.* for Veal 5*s.* 10*d.* ½, for Pigeons 3*s.* 6*d.* for Pies and Tarts 4*s.* 6*d.* I demand what ſhe has laid out in all, and what is the Balance due to her Maſter?

Anſwer. Laid out in all 1*l.* 10*s.* 7*d.* ½. due to her Maſter 1*l.* 1*s.* 10*d.* ½.

5. A Gentleman gave his Servant or Houſekeeper 10 Guineas on the *Monday* to provide every Thing for the Family for the whole Week; and on *Saturday* Evening ſhe brought in her Accounts of Diſburſements as follows. Laid out on *Monday* 1*l.* 11*s.* 6*d.* ½. on *Tueſday* 14*s.* 7*d.* on *Wedneſday* 10*s.* 9*d.* ¼, on *Thurſday* 18*s.* 6*d.* on *Friday* 2*l.* 17*s.* 11*d.* and on *Saturday* 4*l.* 7*s.* 10*d.* I demand what is the Balance, and to whom due?

Anſwer. There is due to the Houſekeeper 11*s.* 1*d.* ¾.

6. A Steward reckoned with one of his Lord's Tenants who owed him a Year and a Half's Rent in a Farm of 450*l.* The Tenant has paid at one Time 50*l.* at another Time 20 Guineas, at another Time 30 Guineas; Repairs by Carpenters Bills 27*l.* 14*s.* 9*d.* by Bricklayers 21*l.* 11*s.* 7*d.* by Land-Tax Bills 83*l.* 17*s.* 9*d.* and by a Bill paid by Order 175*l.* 8*s.* 6*d.* I demand what is the Balance, and to whom due?

Anſwer. Due ſtill to the Landlord, 38*l.* 17*s.* 5*d.*

A RULE to work all ſuch like Queſtions.

Note. My dear young Tyro, always remember to read the Sum two or three Times over very ſlowly and attentively; and then obſerving well the Debt, or what is owing, place that down firſt; then proceed to ſet down all the leſſer Sums, or whatever has been paid, one under another in Order, and then take or ſubtract their Sum or Total out of the firſt Number or Debt, the Remainder will be the Balance.

Note 2. Sometimes it may happen, that what is paid may be more than what is borrowed, &c.— Be this as it will, you muſt ſtill ſubtract the leſſer Number from the greater, and it will be eaſy to ſee on which ſide the Debt is, or to whom the Balance is due, if you will duly attend to the Queſtion.

Take an EXAMPLE.

A Gentleman puts into a Banker's Hand 4605 *l.* and draws out at one Time 1748*l.* 10*s.* at another Time 659*l.* 14*s.* 6*d.* at another Time 2000*l.* at another Time 549*l.* 11*s.* I demand the Balance, and to whom due?

An-

Anſwer. Due to the Banker 352*l.* 15*s.* 6*d.*— That is, the Gentleman has drawn out of the Banker's Hand 352*l.* 15*s.* 6*d.* more than the Banker had of him.

Note 3. Sometimes it happens that there are very long and tedious Reckonings between two Parties, both having paid Money to, and received Caſh of each other, in Part, for various Commodities, and the Accompts often become very intricate for want of being duly ſettled. In ſuch Caſes as theſe the following Example and Diſcharge will be highly neceſſary.

EXAMPLE.

William Snip, the Taylor, and *Richard Tripe*, the Shoe-maker, had a Reckoning of three Years and a Half ſtanding, each of them ſuppoſed the other to owe him Money upon Balance; but at laſt a Day was ſet and they reckoned, and there appeared due to Mr. *Snip* the Taylor, 5*l.* 14*s.* 6*d.* but Mr. *Tripe* could not pay the Balance.—— I demand what ſort of Note Mr. *Tripe* ought to give to Mr. *Snip?*

Anſwer. As follows:

June 24, 1764. *Reckoned and balanced all Accompts between me and Mr.* William Snip *to this Day: And I acknowledge myſelf to be indebted to the ſaid William Snip, Five Pounds, Fourteen Shillings and Six-pence, which I promiſe to pay to him or Order on Demand, for Value received.*

Atteſted *Witneſs my Hand,*
John Truſty. *Richard Tripe.*

N. B. This is a proper Form after ſettling long Reckonings, and the Note ſhould be atteſted by a Witneſs.

SECT. VIII.

MULTIPLICATION of different DENOMINATIONS.

Sch. *WHAT do you mean by* Multiplication *of* different Denominations?

Maſt.

Maſt. Multiplication of different Denominations is where Sums of different Kinds are to be multiplied by one common Multiplier.

*** This Rule, well applied and well attended to, is the beſt practical Syſtem to caſt up or tell the value of any Commodity, at any Price per Yard, Pound, Hundred Weight, Gallon, &c. It is ſo ſimple in itſelf, that for a conſtant Practice of 14 years in my own public Teaching, I ſeldom met with a Boy ſo dull but he was ſoon able to comprehend the Nature of the Rule itſelf, and the Manner how to work it.--- And therefore I would adviſe all Maſters to teach their Scholars this ſhort and eaſy Method of caſting up the Price of various Commodities, till they are quite perfect in it.

Sch. *What do you mean by Queſtions of* Multiplication?

Maſt. Queſtions performed by *Multiplication* only, in Order to ſave the Trouble of the *Rule of Three*, or *Practice*.

Sch. *How is this Rule performed?*

Maſt. In the very ſame Manner as common *Multiplication*, only you muſt have due Regard to the Place of Pounds, Shillings, Pence, and Farthings.

EXAMPLES.

1. What coſt 4 Yards, at

	s.	*d.*	
	3	2	per Yard?
		4	
Anſ.	12	8	

2. What coſt 7 Gallons, at

	2	4	per Gallon?
		7	
Anſ.	16	4	

3. What coſt 9 Ells, at

	8	6½	per Ell?
		9	
Anſ.	3	16	10½

Here

Here you ſee, in theſe three Examples, I only multiply the Price of the Commodity by the Number of the Things ſold or bought, and carry as in *Addition* of Money.

EXAMPLES for Tryal.

4. What coſt 7 Ells, at 4*s*. 7*d*.½ per Ell?
Anſ. 1*l*. 12*s*. 4*d*.½

5. What coſt 9 Buſhels, at 4*s*. 7*d*.¼ per Buſhel?
Anſ. 2*l*. 1*s*. 5*d*.¼

6. What coſt 10 Pigs, at 11*s*. 6*d*.½ each?
Anſ. 5*l*. 15*s*. 5*d*.

7. What coſt 11 Sheep, at 1*l*. 10*s*. 9*d*. each?
Anſ. 16*l*. 18*s*. 3*d*.

8. What coſt 12 Calves, at 3*l*. 7*s*. 6*d*. each?
Anſ. 40*l*. 10*s*.

Sch. *But ſuppoſe the Number ſhould be above* 12, *how ſhall I proceed then?*

Maſt. You muſt divide the Number into two ſuch Parts, as when multiplied together, will make the whole Number; thus ſuppoſe the Numbers were 24, 32, or 35—I ſay 6 Times 4 is 24, or 4 Times 6 make 24, ſo I multiply by 4 firſt, and then I multiply the Product by 6, which is the ſame Thing as multiplying by 24: So alſo for 32, I multiply by 4 firſt, then by 8; for 35, I multiply firſt by 7, and then the Product by 5, for 5 Times 7 is 35, and for 54 by 6, and then again by 9, *&c.* An Example or two will make it plain.

EXAMPLES.

		s.	*d*.	
9. What coſt 15 Yards, at		3	9	per Yard.
3 Times 5 is 15; multiply by			3	
		11	3	Price of 3
then by			5	5
Anſ. *£*.	2	16	3	Price of 15

10. What

10. What coſt 24 Ells, at 7 $9\frac{1}{2}$ per Ell?
4 Times 6 is 24; multiply by 4

	£.				
	1	11	2	Price of	4
then by			6		6
Anſ. £.	9	7	0	Price of	24

11. What coſt 35 Loads, at £. 1 5 $6\frac{1}{2}$ per Load?
5 Times 7 is 35; multiply by 5

	£.				
	6	7	$8\frac{1}{2}$	Price of	5
			7		7
Anſ. £.	44	13	$11\frac{1}{2}$	Price of	35.

Thus you ſee the Work is done at two Operations, and in the ſame Manner you are to proceed with the Numbers in the following Examples.

EXAMPLES for Exerciſe.

12. What coſt 42 Gallons, at 4s. 9d. $\frac{1}{2}$ per Gallon?
Anſ. 10l. 1s. 3d.

13. What coſt 56lb. at 13s. 9d. per lb. *Anſ.* 38l. 10s.

14. What coſt 63 Buſhels, at 9s. 3d. per Buſhel?
Anſ. 29l. 2s. 9d.

15. What coſt 72 Chaldron, at 1l. 7s. 6d. per Chaldron? *Anſ.* 99l.

16. What coſt 84 Dozen, at 6s. 9d. $\frac{3}{4}$ per Dozen?
Anſ. 28l. 12s. 3d.

17. What coſt 96 Groſs, at 11s. 4d. $\frac{1}{2}$ per Groſs?
Anſ. 54l. 12s.

18. What coſt 100 Gallons, at 14s. 10d. per Gallon?
Anſ. 74l. 3s. 4d.

19 What coſt 108 Butts, at 3l. 15s. per Butt?
Anſ. 405l.

20. What coſt 121 Pipes, at 10l. 17s. per Pipe?
Anſ. 1312l. 17s.

21. What

21. What coſt 132 Loads, at 5l. 10s. 9d. per Load?
Anſ. 730l. 19s.

22. What coſt 144 Bullocks, at 14l. 15s. each?
Anſ. 2124l.

*** Look into your Multiplication Table, and you will ſoon find two Numbers that will make any one of theſe; as in Example 12 it is 42; therefore, I multiply by 6, and then by 7; and for 56, by 7 and by 8, and ſo for the Reſt.

Sch. *I underſtand you, Sir; but ſuppoſe the Number ſhould be ſuch as cannot be made up by any 2 Figures multiplied into each other, what muſt be done then?*

Maſt. Take any two Numbers that will come the neareſt to the Number, (but ſo as not to exceed it) and then add the odd Number or Numbers to it. Thus, ſuppoſe it was required to tell what 43 Gallons come to at 4s. 9d. ½ per Gallon; I multiply by 6 and by 7, which is the ſame Thing as multiplying by 42, and find that it comes to 10l. 1s. 3d. as in Example 12) then for the odd one to make it 43, I add 4s. 9d. ½ to the aforeſaid Sum of 10l. 1s. 3d. and it makes 10l. 6s. od. ½, the Anſwer for 43 Gallons: So alſo ſuppoſe the Number was 58, I ſay 7 times 8 is 56; I therefore multiply by 7 and 8 firſt, and then I add the Price of two odd Numbers to make 58—Thus 58 Weeks Work, at 7s. 9d. per Week, you will find to be 22l. 9s. 6d.

Sch. *I underſtand you now very well.*

Maſt. Then we will proceed to *Diviſion.*

SECT. IX.

DIVISION of different DENOMINATIONS.

Sch. *WHAT do you mean by* Diviſion *of different* Denominations?

Maſt. Diviſion of different Denominations is where ſeveral Sums of different Kinds are to be divided by one common *Diviſor.*

Sch.

Sch. *How is this Rule performed?*

Mast. Divide the first Denomination on the left Hand by the Divisor, and set down the Quotient. If any thing remains, multiply it by as many of the next Denomination as make one of the foregoing. Carry the Product to the next Denomination, and divide it as before. Proceed in the same Manner with all the other Denominations.

EXAMPLES.

Divide
By 4)4l. 12s. 8d. into 4 Parts.

1l. 3s. 2d. Ans.

Divide
By 8)17l. 16s. 6d. into 8 Parts.

2l. 4s. 6d. $\frac{3}{4}$ Ans.

In Example 1st, I only say the 4th Part of 4l. is 1l. the 4th of 12s. is 3s. and the 4th Part of 8d. is 2d. In Example 2d, I say the 8th Part of 17l. is 2l. and 1l. over, which I carry to the Shillings, and it is 1l. 16s. or 36s. then the 8th Part of 36s. is 4s. and 4s. over, which I carry to the Place of Pence, and it is 4s. 6d. now the 8th Part of 4s. is 6d. and the 8th Part of 6d. is 3 Farthings. Pray now look at the Example carefully, and you will soon understand the following.

More EXAMPLES.

	l.	s.	d.		l.	s.	d.		l.	s.	
By 6)	47	10	6	By 8)	25	14	4	By 9)	64	18	
Ans.	7	18	5	Ans.	3	4	$3\frac{1}{2}$	Ans.	7	4	3
By 7)	53	1	$11\frac{1}{2}$	By 9)	27	16	$10\frac{1}{2}$	By 12)	173	15	3

Questions

Queſtions for Exerciſe.

1. A Gentleman dying, left to 5 poor Widows of his Pariſh 282l. 17s. 11d. to have an equal Share alike, I demand what each Widow had?

Anſwer. 56l. 11s. 7*d.*

Sch. *How do you divide by the Parts of any Number inſtead of the Whole?*

Maſt. When the Diviſor is ſuch a Number, that any two Figures being multiplied together will make the ſaid Diviſor, you may divide the given Number by one of thoſe Figures, and the Quotient thence ariſing by the other, which will be the ſame Thing as dividing by the whole Numbers.

EXAMPLES.

2. A Butcher bought 14 Sheep, which coſt him 10l. 18s. 2d. I demand what they coſt him a-piece, or what each coſt?

Anſwer. 15s. 7d.

Divide by 2 and then by 7, for 2 times 7 is 14.

3. A Gentleman gave 13l. 19s. 2d. to be divided equally among 100 School-Boys, who had particularly minded their Learning, and were very good at Home and at School. I demand how much each Boy had?

Anſwer. 2s. 9d.$\frac{1}{2}$ each.

Divide by 10 and by 10.

BILLS of PARCELS.

In which the Sums are only expreſſed in Words, that the young Scholar may have an Opportunity of extending them in Figures, and caſting them up.

A Houſekeeper's Bill of Diſburſements.

1764.		l.	s.	d.
Apr. 13.	Laid out for 12lb. of Beef, four Shillings and ſeven Pence, - - -			
14.	Candles, ten Groats, - - -			
16.	Parſnips, Carrots, Greens, and Potatoes, fifteen Pence Halfpenny,			
17.	Cheeſe and Butter, three Shillings and five Pence, - - - - -			
18.	Bread, one and twenty Pence Halfpenny, - - - - - - - - -			
	Flour and Muſtard, thirteen Pence,			
	A Piece of Iriſh, three Pounds, four Shillings, and nine Pence, -			
	In all			

A BOOK DEBT.

A Merchant propoſes to leave off Trade, and finds in his Books ſix Perſons that ſtand in Debt to him as follows:

	l.	s.	d.
A owes him one Hundred and forty-ſeven Pounds, ſeventeen Shillings and Nine-pence,			
B—— fifty-four Pounds and three Half-pence,			
C—— two Thouſand Pounds, and Six-pence,			
D—— ſeventeen Pounds, four Shillings,			
E—— ſix Thouſand and fifty Pounds, nine Shillings, and Four-pence Farthing, -			
F—— one Hundred Pounds, and three Farthings, - - - - - - - - - - -			
Due to him in all			

More EXAMPLES.

In which the Sums are expreſſed in Figures, and extended, but not caſt up.

A CHEESE-

A CHEESEMONGER's BILL.

Mr. *Roberts* bought of *Geo. Cream*, February 17, 1764.

			£.	s.	d.
A Cheshire Cheese	30lb.	at 4d. *per* lb.	0	10	0
4 Glouceſter -	40	at 3d. ½ -	0	11	8
2 Warwickſhire	22	at 3d. - -	0	5	6
1 Side of Bacon	71	at 6d. - -	1	15	6
9lb of Butter -	-	at 7d. ½ - -	0	5	7½
2 Firkins of Butter -		at 28s. per Firkin,	2	16	0
5lb. of Ribs of Bacon		at 8d. ½ per lb.	0	3	6½
		Total £.			

A WOLLEN-DRAPER's BILL.

Mr. *Tarewell* bought of *John Snip*.

1764			£.	s.	d.
Feb. 4.	13 Yds. of Shalloon	at 1s. 9d. per Yd.	1	2	9
	5 Yds. of Broad Cloth	at 13s. - -	3	5	0
7.	6½ of Scarlet ſuperfine	at 21s. - -	6	16	6
	4½ of Drugget	at 5s. 6d. -	1	4	9
Mar. 2.	11 Yards of Serge	at 2s. 3d. - -	1	4	9
15.	5 Yds. black hair Shag	at 10s. 6d. -	2	12	6
	15 Yards of Frieze	at 4s. 9d. -	3	11	3
		Total £.			

A GROCER's BILL.

Mr. *Salmon* bought of *Wm. Sweet*, Jan. 5. 1764.

		£.	s.	d.
8 lb. of Coffee	at 3s. 6d. per lb.	0	7	0
2 ſingle refined Sugar-Loaves,	14lb. at 9½	0	11	1
1 double refined -	6½ lb. at 10 ½0	0	5	8¼
28 lb. of Sugar - -	at 5d. ½	0	12	10
1 lb. of Hyſon Tea, at 16s.	1 lb. of Bohea 7s.	1	3	0
3 oz. of Cloves, 1 of Ginger,	1 of Mace	0	4	9
40lb. of Liſbon Sugar - -	at 6d. ½	1	1	8
15lb. of coarſe Sugar - -	at 3d. ½	0	4	4½
49lb. of Malagas - -	at 4d. ½	0	18	4½
2lb. of Chocolate - - -	at 5s. 6d.	0	11	0
Nutmegs and Cinnamon - - - -		0	0	7½
	Total £.			

A TAYLOR's BILL.

Mr. *Nothought*, Dr. to *Jonathan Snipclose*.

1764.		l.	s.	d.
Jan. 3.	Making a full-trimmed Suit	2	2	0
	5½ Yards of Shaloon, at 2s. 3d. per Yd.	0	12	4½
	2 Dozen beſt gilt Coat Buttons	0	5	6
	2 Dozen of Waiſtcoat - - -	0	3	6
	Buckram, Canvas, and Stay Tape	0	3	9
	Silk, Twiſt, and Mohair - -	0	4	4
Feb. 12.	Making a black Velvet Waiſtcoat	0	4	6
	Silk, Twiſt, and Mohair - -	0	2	3
	Dimity, and Pockets	0	1	4
	5 Yards of Lace, at 3s. 6d. per Yard	0	17	6
17.	Seating 2 Pair of Breeches	0	3	6
	Various Jobs in Mending	0	2	8
25.	6 Yards of Fuſtian, at 2s. 9d. per Yd.	0	16	6
	3½ Yds. of Shaloon for the ſame at 2s. 2d.	0	7	7
	Buckram, Stay-Tape, &c.	0	1	9
	Silk, Twiſt, and Mohair	0	2	7
	Making the Frock - - -	0	7	6
	Total £.			

March 4, 1764, Received the Contents of this Bill.

JONATHAN SNIPCLOSE.

A STATIONER's BILL.

Mr. *Quilldrive* bought of *John Ragg*, Feb. 17, 1767.

12 Reams of Fool's-cap, at 14s. 6d. per Ream	8	14	0
7 Reams of Pot, at 8s. 6d. - - -	2	19	6
3 Thouſand Quills, at 7s. 9d. per Thouſand	1	3	3
1 Box of Wafers, Pounce, and Sealing-Wax	0	1	7½
1 large Accompt Book ruled - -	0	8	6
2 Skins of Parchment - -	0	7	4
3 Reams of Demy Paper, at 2l. 2s. per Ream	6	6	0
1 large black Pocket-Book gilt - -	0	4	6
2 Caſh Books, 3 Quires, ruled - -	0	5	0
3 Sheet Almanacks, 1 Pocket, ditto - -	0	1	5½
1 Pocket Book, Vellum, ruled - -	0	2	6
Total £.			

April 4, 1767, Received for Mr. *Ragg*, the Contents of this Bill.

TIM POUNCE.

*** The

*** The foregoing Receipts are ſufficient Examples for all the preceding, or any other Bills, and the Forms are adapted to Buſineſs; for there is no Occaſion to ſay *in full of all Demands*, except in long Reckonings and ſome particular Circumſtances, and then indeed Receipts are varied accordingly, of which I have given a particular Account at the End of Subtraction, where I have ſhewn the Manner of balancing and ſettling any common Accompts.

SECT. X.

REDUCTION.

Sch. *WHAT is* Reduction?

Maſt. Reduction is the Art of reducing Numbers of one Denomination into Numbers of another Denomination; as Pounds into Shillings, Shillings into Pence; Nails into Quarters, Quarters into Yards, &c.

Sch. *How many Kinds of Reduction are there?*

Maſt. Two; *Reduction aſcending*, and *Reduction deſcending*.

I. *Reduction aſcending*, teaches to reduce Things of a ſmaller Denomination into Things of a greater; as Farthings into Pence, Shillings, or Pounds; Minutes into Hours, Days, or Weeks, &c.

II. *Reduction deſcending* teaches to reduce Things of a greater Denomination into Things of a ſmaller; as Pounds into Shillings, Pence, or Farthings; Hundred Weights into Pounds or Ounces; Miles into Yards, Inches, &c. This laſt is rather the more eaſy of the two; and therefore I ſhall ſpeak of it firſt.

N. B. *Reduction aſcending* is always performed by Diviſion, and *Reduction deſcending* is performed by Multiplication.

I. *Of* REDUCTION DESCENDING.

RULE.

Always multiply by as many of the leſs Denomination as make one of the greater, and you have the Anſwers.

EXAMPLES.

1. In 25 *l.* how many Shillings?

20*

Shill. 500 Anſwer.

2. In 27 *s.* how many Pence?

12*

Anſw. 324 Pence.

* Here 20 Shillings make a Pound Sterling, and 12 Pence a Shilling, therefore I multiply by theſe.

3. In 175 *l.* 17 *s.* 6 *d.* ½ how many Shillings, Pence, and Farthings?

** 175 17 6½

20

3517 Shill.

12

42210 Pence

4

168842 Farthings

Again, 409 15 9¾

20

8195 Shill.

12

98349 Pence

4

393399 Farthings

** Remember always to take in the odd Shillings, Pence, and Farthings. Thus, I take in 17 Shillings when I multiply by 20; the 6 Pence when I multiply by 12; and the Halfpenny when I multiply by 4.

I ſhall not ſet down the Anſwers to the following Queſtions, as it cauſes a Supineneſs in the Learner, and in ſome Caſes may rather hurt than do him good: But I here rather chuſe to ſet down what he is to multiply by, and that will not only enable, but encourage him to perform the Operations.— The Reaſon why he is to multiply by ſuch and ſuch Figures it can be no Trouble for any Maſter to tell him, and he will eaſily underſtand the Reaſon when given, though perhaps he could not find out the Figures himſelf.

4. In

4. In 45 Guineas, how many Shillings and Groats? —*Rule*, Multiply by 21, and by 3.

5. In 27 Moidores and 11 Shillings, how many Shillings, Six-pences, and Pence?— Multiply by 27, and take in the 11 Shillings, then by 2 for the Six-pences, and by 6 for the Pence.

6. In 120 Portugal Pieces of 36 Shillings each, how many Shillings and Halfpence?— Multiply by 36, and then by 24.

AVOIRDUPOISE WEIGHT.

7. In 17lb. 14oz. 11dr. how many Ounces and Drams?— Multiply by 16, and take in the 14; then Multiply by 16, and take in the 11.

8. In 14C. 3qrs. 17lb. how many Quarters, Pounds, and Ounces?— Multiply by 4, and take in the 3 Quarters; then by 28 and take in the odd 17lb. and then at laſt by 16, you will have the Ounces.

TROY WEIGHT.

9. In 3lb. 5oz. 11dwts. 17grs. how many Ounces, Pennyweights and Grains?— Multiply by 12, by 20, and by 24, taking in the odd 5oz. 11dwts. 17grs.

DRY MEASURE.

10. In 47 Loads, 14 Buſhels, how many Buſhels and Pecks?— Multiply by 40, taking in 14, and you have the Buſhels, and then by 4, and you have the Pecks.

LIQUID MEASURE.

11. In 14 Butts, 2 Barrels, how many Barrels and Gallons?— Multiply by 3, and take in 2, and you have the Barrels, then by 36, and you have the Gallons.

CLOTH MEASURE.

12. In 47 Yards, 2 Quarters, how many Quarters and Nails?— Multiply by 4 for Quarters, and again by 4, for the Nails.

13. In

13. In 34 Ells Engliſh, how many Quarters and Nails?—Multiply by 5, and then by 4; or by 4 and then by 5.

LONG MEASURE.

14. In 47 Miles, 4 Furlongs, 27 Rods, how many Furlongs and Rods?—Multiply by 8, and then by 40.

15. In 417 Yards, 2 Feet, 2 Inches, how many Feet, Inches and Barley Corns?— Multiply by 3, by 12, and by 3.

TIME.

16. In 24 Days, 17 Hours, 45 Minutes, 35 Seconds, how many Hours, Minutes, and Seconds?— Multiply by 24, by 60, and by 60.

2. REDUCTION ASCENDING.

Sch. *I underſtand what you have ſaid about Reduction deſcending; pray give me ſome Examples in Reduction aſcending, and tell me how I am to work them?*

Maſt. I will.— You are to proceed then in a Manner juſt the reverſe of what you followed in the laſt Rule, and divide by the ſame Numbers in the ſame Caſes, as you before multiplied by.

EXAMPLES.

1. In 5407 Shillings, how many Pounds Sterling?— Divide by 20, you will find the Anſwer 270l. 7s.

2. In 6472 Pence, how many Shillings and Pounds Sterling?— Divide by 12, and you will have 539s. 4d. and then by 20, and you will have 26l. 19s. 4d.

3. In 4075326 Farthings, how many Pence, Shillings, and Pounds Sterling?— Divide by 4, and you will have 1018831d. $\frac{1}{2}$; by 12, and you will have 84902s. 7d.; and then by 20, and you will have at laſt 4245l. 2s. 7d. $\frac{1}{2}$.

4. In 144000 Farthings, how many Pence, Threepences, half Crowns, Crowns and Pounds?

Anſ.

Anſ. 36000 Pence, 12000 Three-pences, 1200 half Crowns, 600 Crowns, and 150l. Sterling.

This is ſufficient for any other Example.

N. B. Remember that whatever remains, after Diviſion, has the ſame Name as the Dividend.

5. In 407651 Farthings, how many Two-pences, Four-pences, Shillings, and Guineas?—Divide by 8, by 2, by 3, and by 21.

AVOIRDUPOISE WEIGHT.

6. In 47645 Ounces, how many Pounds, Quarters, and Hundred Weights?—Divide by 16, by 28, and by 4.

TROY WEIGHT.

7. In 471602 Grains, how many Pennyweights, Ounces and Pounds Troy?—Divide by 24, by 20, and by 12.

BEER MEASURE.

8. In 146219 Pints, how many Quarts, Gallons, Firkins, Kilderkins, Barrels and Butts?—Divide by 2, by 4, by 9, by 2, by 2 again and by 3.

DRY MEASURE.

9. In 30721 Pints, how many Pecks, Buſhels, Quarters, and Loads?—Divide by 16, by 4, by 8, and by 5.

CLOTH MEASURE.

10. In 941 Nails, how many Quarters and Yards?—Divide by 4 and by 4.

LONG MEASURE.

11. In 471635 Inches, how many Feet and Yards?—Divide by 12, and by 3.

12. In

LAND MEASURE.

12. In 4760 Rods, how many Acres?— Divide by 160, you have Acres, and the Remainder will be Rods, which divide by 40, you will have the Roods, *viz.* 29 Acres, 3 Roods.

TIME.

13. In 47620 Minutes, how many Hours, Days, and Weeks?—— Divide by 60 for Hours, by 24 for Days, and by 7 for Weeks.

PRACTICAL QUESTIONS.

14. In 34675 Farthings, how many Pence, Three-pences, Six-pences, Shillings, and Crowns?—— Divide by 4, by 3, by 2, by 2 again, and then by 5.

15. In 40729 Halfpence, how many Groats, Shillings, Crowns and Pounds?

3. REDUCTION ASCENDING *and* DESCENDING, *being proper* EXERCISES *both for* Inſtruction *and* Practice.

Sch. *I hope, Sir, you will give me an Example or two at large.*

Maſt. I will do any Thing to ſet you forward; but you muſt on your Part be very diligent to remember what to multiply and divide by, as I have taken (you know) great Pains to remind you of it continually: I will give you two Examples with their Proofs.

EXAMPLES.

1. In 27l. 14s. 9d.$\frac{3}{4}$ how many Shillings, Pence, and Farthings?

27 *l.*

l.	*s.*	*d.*
27	14	9¾
20		
554 Shillings		
12		
6657 Pence		
4		
26631 Farthings		

Proof

4)26631 Farthings

12)6657¾ Pence

2|0)55|4 os. and 9d.

** 27l. 14s. 9¾d.

In 125l. 15s. how many Shillings, Groats, Pence, and Halfpence?

l.	*s.*	*d.*
125	15	0
20		
2515 Shillings		
3		
7545 Groats		
4		
30180 Pence		
2		
60360 Half-pence		

Proof

2)60360 Half-pence

4)30180 Pence

3) 7545 Groats

2|0)251|5 Shillings

** 125l. 15s.

** You see in the Proof of these Examples, that I divide every Product back again by the same Figures I multiplied by; and if every Quotient answers to its foregoing Product, you may depend upon it the Work is right, otherwise it is wrong.

Sch. *I see plainly the Manner of working these Questions: but how am I to reduce foreign Money into Pounds Sterling, as I am unacquainted with foreign Coins?*

Mast. The following Table will be of Service to you for that Purpose.

A TA-

A TABLE of FOREIGN COINS.

Name.	What Country.	The Value. l.	s.	d.
Abaſſi	A *Perſian* Coin		1	4
Cabeſqui	*Ditto*			5½
Coupant of Gold	*of Japan*	6	12	6
Ditto	*Ditto*	2	4	0
Ditto of Silver	*Ditto*		4	6
Croiſat	*of Genoa*		6	6¾
Crown	*French*		4	6
Ditto	of *Rome*		5	1
A Dollar	*Italy or Spain*		4	6
A Lion Dollar	*Holland*		3	7
A Croſs Dollar	*Ditto*		4	2
A Specie Dollar	*Ditto*		5	0
A *Zeland* Dollar	*Ditto*		3	0
Leopold's Dollar	*Ditto*		4	3
Dollar, Prince of Orange	*Ditto*		4	4
Dollar	of *Dantzick* or *Sweden*		2	3
Rix-Dollar	*Holland*		4	4½
Ditto	*Hanover*		4	7
Ditto	*Hamburgh*		4	7
Ditto	*Flanders*		4	6
Ducat	*Holland*		9	3
Ditto	*Poland*		4	6½
Ditto	*Naples*		3	4½
Ditto	*Leghorn*		5	4½
Ducatoon	*Holland*		5	5½
Pound	*Flanders*	1	13	4
A piece of Eight	*Spaniſh*		4	6
A *Mexico* piece of Eight			4	4½
Florin	*Palermo*		1	3
A Livre	*France*			10½
A Mark	*England*, not current		13	4
Mill-Ree	*Portugal*		6	9
Moidore, 4 Mill-Rees		1	7	0
Ruble	*Muſcovy*		4	6
Xeriff	*Turkey*		9	6

EXAM-

EXAMPLES.

3. In 347*l.* 15*s.* how many Shillings, Crowns, ½ Crowns, and Pence?

Anſ. 6955 Shillings, 1391 Crowns, 2782 half Crowns, and 83460 Pence.

4. In 47163 Groats, how many Pence, 6 Pences, ½ Crowns and Pounds?

Anſ. 188652 Pence, 31442 Six-pences, 6288 ½ Crowns, and 12 Pence over, and 786*l.* 15*s.*

5. In 4760 French Crowns, at 4*s.* 6*d.* each, how many Livres, Pence, Shillings, and Guineas?

Anſ. 24480 Livres, 257040 Pence, 21420 Shillings, and 1020 Guineas.

6. In 100*l.* how many Guineas, Crowns, and 3 Pences?

Anſ. 95 Guineas and 5 Shillings over, 400 Crowns, and 8000 3 Pences.

7. How many Guineas, Pounds, Shillings, and Crowns are there in 140 *Portugal* Pieces?

Anſ. 240 Guineas, 252 Pounds, 1008 Crowns, and 5040 Shillings.

8. In 4916 Ducats of *Poland*, at 4*s.* 6*d.* ¼ each, how many Rix-Dollars of *Flanders*, at 4*s.* 6*d.* each?

Anſ. 4938, and 3*s.* 5*d.* over.

9. In 47640 *Palermo* Florins, at 15*d.* each, how many Crowns, Shillings, Pounds, and *Portugal* Pieces?

Anſ. 11910 Crowns, 59550 Shillings, 2977*l.* 10*s.* and 1654 *Portugal* Pieces, and 6*s.* over.

10. A Merchant in *London* ſends his Correſpondent in *Holland* as much Tobacco as comes to 1201*l.* 5*s.* and is to receive the ſame in Croſs Dollars, at 4*s.* 2*d.* each, how many muſt he receive?

Anſ. 5766.

11. In 6492 Ports, how many Moidores?

Anſ. 8656.

12. In 8656 Moidores, how many Ports?

Anſ. 6492.

Note. In all ſuch Queſtions as theſe, after the Learner has multiplied by 36, and divided by 27, according to the common Way: Let him be told that to multiply by 4, and divide by 3, will anſwer the ſame End (in Queſtion 11th) becauſe 27 is three quarters, or three Quarters of 36—And in Queſtion the 12th, he muſt multiply by 3, and divide by 4; becauſe there will be juſt one fourth leſs Ports than Moidores; this will lead him into the practical Part of Arithmetic, which is ſo neceſſary in Buſineſs, and the Want of which is ſo much complained of in Compting-Houſes, where Diſpatch is required.

13. *In 200 Ports how many Pounds, ½ Crowns, Crowns, Pence, and Groats?

Anſ. 360 Pounds, 1440 Crowns, 2880 Half Crowns, 86400 Pence, and 21600 Groats.

* *Note.* This, and ſuch like Queſtions, may often be done 2 or 3 different Ways; and the Learner ought to be told that he need not follow exactly the Words of the Queſtion, but attend only to the Nature of it— Thus, Queſtion the 13th requires half Crowns firſt, and then Crowns; by which Means there will be occaſion firſt to multiply the Pounds by 8 for half Crowns; then to divide by 2 for the Crowns; then to multiply by 60 for the Pence, and to divide by 4 for the Groats— Whereas I would find the Crowns firſt by multiplying the Pounds by 4; then by 2 for the half Crowns; then by 30 for the Pence; and divide by 4 for the Groats: Thus have you but one Diviſion, which is much better. This is all I ſhall ſay upon any Thing of this Sort, as the Hint will be ſufficient for any practical Maſter and diligent Scholar.

14. A rich Man had 6 Villages, every Village 4 Streets, every Street 40 Houſes, every Houſe 6 Rooms, every Room 3 Bureaus, every Bureau 20 Drawers, in every Drawer were 4 Purſes of Gold, each Purſe contained 200 Guineas; I demand how many Pounds, Shillings, Pence, and Farthings are in all?

Anſ. 290304000 Pounds, 5806080000 Shillings, 69672960000 Pence, and 278691840000 Farthings.

15. A Farmer has 6 Folds, in every Fold 20 Sheep, each Sheep has 3 Lambs: The Sheep to be ſold for 1*l.* 3*s.* 6*d.* each, and the Lambs for 2*s.* 2*d.* each. I demand how much he made of them?

Anſ. The Value of the Sheep is 141*l.* and the Lambs 39*l.*

6. Sup-

6. Suppoſe there were 2000 Men at the taking of *Quebec*, and that they found in it 87653*l.* 10*s.* that the General had for his Share 15000*l.* that 10 principal Officers had each 1000*l.* and the Remainder was equally divided among the 1989 common Men. I demand how much each had?

Anſ. Each common Man had 30 Guineas, *viz.* 31*l.* 10*s.* each.

17. A curious old Gentleman had heaped together a great Number of all the *Engliſh* Silver Coins, *viz.* Crowns, half Crowns, Shillings, 6 Pences, 4 Pences, 3 Pences, 2 Pences, and Pence, and when he died he left his Grand Daughter 140*l.* 2*s.* it was to be paid her in theſe Pieces, and to have of each an equal Number. I demand how many of each ſhe ought to receive?

Anſ. 285 of each.

18. How many Legs, Heads, and Tails have a 11 Dozen Dogs? *Anſ.* 792.

19. A Merchant in *London*, has a Debt due upon his Correſpondent in *Holland*, for 2570*l.* 14*s.* 6*d.* Sterling; and his Correſpondent remitted the Payment in Duccatoons at 5*s.* 5*d.* $\frac{1}{2}$ each; how many Duccatoons muſt he receive?

Anſ. 9419 duc. and 2*s.* 5*d.* $\frac{1}{2}$.

20. In 747699 Pence, how many Crowns, Guineas, *Mexico* Pieces of Eight, at 4*s.* 4*d.* $\frac{1}{2}$ each, and *Flemiſh* Pounds at 33*s.* 4*d.*?

Anſ. 12461 Crowns, 39*d.* over; 2967 Guineas, and 15*d.* over; 14241 *Mexico* Pieces, and 93 Halfpence, or 3*s.* 10*d.* $\frac{1}{2}$ over; and 1869 *Flemiſh* Pounds, and 99*d.* or 8*s.* 3*d.* over.

AVOIRDUPOISE WEIGHT.

21. In *14*C.* 3*q.* 10*lb.* how many Quarters, and Pounds? *Anſ.* 59*q.* or 1662*lb.*

* *Note.* There are two Methods to reduce Cwts. into lbs. and both better than the common Way. 1ſt, Set down the Hundred Weights 4 times under each other in the following Manner; then add them together, and the Sum is the Number of Pounds contained in them: to this add the odd Pounds, and the Work is done.

Cwts.	*q.*	*lb.*
14	3	10
14		
14		
14		

1568 *lb.* in 14 Cwt.
94 in 3 *q.* 10 *lb.*

1662

Another ſhorter Way; Multiply the Cwt. by 12, and ſet 2 Figures out to the Left Hand; put the odd Weight underneath and add all 3 together: Thus,

Cwts.
14— Multiply by 12
168
94 odd Pounds

Anſ. 1662 as before

TROY WEIGHT.

22. Suppoſe I have 319 Ingots of Silver, each weighing 22 *lb.* 10 *oz.* 19 *dwts.* 11 *grs.*; how many Dozen of Plates may be made out of this Quantity, ſuppoſing each Plate to weigh 11 *oz.* 13 *dwts.* 16 *grs.*

Anſ. 625 Dozen, and 7 Plates $\frac{4597}{4608}$.

WINE MEASURE.

23. In 518 Pipes of Wine, each 126 Gallons; how many Caſks containing each 33¼ Gallons, or 33 Gallons, 2 Pints.

Anſ. 1962 Caſks, 126 Quarts, or 252 Pints, or 31 Gallons and a half.

24. A Captain of a Ship bought 106 Butts 1 Barrel of Porter, of a Victualler, to carry with him in his Voyage: He is to have the whole delivered in Bottles containing 4 to a Gallon; I demand how many Dozen of Bottles there were? *Anſ.* 3828.

LONG MEASURE.

25. How many Furlongs, Yards, and Inches are contained between *London* and *Harwich*, ſuppoſing it to be 60 Miles, 4 Furlongs?

Anſ. 484 Furlongs, 106480 Yards, and 3833280 Inches.

26. How many Furlongs, Yards, Feet, Inches and Barley-corns are contained in the Circumference of the whole Globe, ſuppoſing it to be 25,000 Miles?

Anſ. 200000 Furlongs, 44000000 Yards, 132000000 Feet, 1584000000 Inches, and 47520000000 Barley-corns.

TIME.

TIME.

27. Suppose I was born in the Year 1715, and the present Year 1764; how many Years, Days, Hours, Minutes, and Seconds or Moments am I old, allowing just 365 Days to the Year?

Anſ. 49 Years, 17885 Days, 429240 Hours, 25754400 Minutes, and 1545264000 Seconds.

28. How many Days, Hours, Minutes, and Seconds are expired ſince the Birth of our Saviour *JESUS CHRIST*, ſuppoſing it 1764 Years, 147 Days, 15 Hours, 45 Minutes, 27 Seconds?

Anſ. 644007 Days, 15456183 Hours, 927371025 Minutes, and 55642261527 Seconds.

SQUARE MEASURE.

Note, Remember that the Square of any Number is the Sum produced by multiplying that Number by itſelf, thus the Square of 4 is $4 \times 4 = 16$; alſo the Square of 12 is $12 \times 12 = 144$.

1. How many Pieces, each 1 Quarter of an Inch Square, may be cut off a Piece of Board, 15 Inches Square? *Anſ.* 3600.

2. How many Marble Stones, each 9 Inches Square, will floor a Room 18 Feet Square? *Anſ.* 576.

3. How many Tiles, 10 Inches Square, will floor a Malt-Kiln 16 Feet long and 12 Feet wide?

Anſ. 276 $\frac{48}{100}$ Tiles, or nearly $276\frac{1}{2}$.

4. How many Deal Boards, 9 Feet 4 Inches long, and 9 Inches wide, will floor a Room 18 Feet long, and 15 Feet wide?

Anſ. $38\frac{576}{1008}$ Boards, or better than $38\frac{1}{2}$.

5. How many Acres are contained in a Field 80 Rods long, and 60 Rods wide? *Anſ.* 30 Acres.

SOLID MEASURE.

This contains Length, Breadth, and Thickneſs; the Way to find out the Contents is to multiply the Length, Breadth, and Thickneſs together.

The RULE.

64 ſolid Quarters make a ſolid Inch, 1728 ſolid Inches make a ſolid Foot, and 27 ſolid Feet make a ſolid Yard. This ariſes from the following Reaſons; $4 \times 4 \times 4 = 64$ Quarters; $12 \times 12 \times 12 = 1728$ Inches, and $3 \times 3 \times 3 = 27$ Feet.

EXERCISES.

1. There is a ſolid Piece of Timber 4 Feet long, 3 Feet wide, and 2 Feet high; how many ſolid Inches does it contain?

Anſ. 41472 Inches, for $4 \times 3 \times 2 \times 1728 = 41472$ Inches.

2. A Perſon has got a Piece of Ivory, 1 Foot 3 Inches long, 10 Inches wide, and 6 Inches thick; and he is to cut it into Dice or Dies, each 1 Quarter of an Inch Square on every Side; how many Dies will it make?

Anſ. 57600.

THE SINGLE RULE OF THREE DIRECT,

Commonly called,

The GOLDEN RULE, or RULE of PROPORTION,

Sch. *WHAT do you mean by the* Rule *of* Three Direct, *or the* Rule *of* Proportion?

Maſt. It is that Rule which teaches the *Ratio*, *Analogy*, or *Proportion*, which Numbers, when compared, bear to each other, and theſe Numbers are never leſs than

than 4, *viz.* 3 which are given in order to find the 4th, and this 4th Number is the Anſwer.

Sch. *Pray explain this farther to me?*

Maſt. I have juſt told you that never leſs than 3 Numbers are given, in order to find out a 4th, and that the 4th Number is the Anſwer required.

Sch. *But how am I to find this 4th Number, before I know how to work the Rule?*

Maſt. You are right: Be careful then to attend to the following Rules or Obſervations, and you will ſoon make yourſelf Maſter of the whole.

RULE I.

Read the Queſtion over 2 or 3 Times with due Conſideration, and you will find every Queſtion conſiſts of three Things or Parts, which when known, it will be eaſy to ſtate the Sums in a Manner fit for working. Thus, if 2 Yards coſt 4*s.* what coſt 8 Yards? *Anſ.* 16*s.*

RULE 2.

3. Now to ſtate this or any other plain Queſtion, you muſt firſt obſerve that there are 2 Numbers of one and the ſame Name or Denomination, and a third Number of a different Denomination. In the preſent Queſtion there are two Numbers of Meaſure, or under the Name of Yard, and one Number is Money; therefore in ſtating it, make your firſt and third Number of the ſame Name: That which ſuppoſes the Thing or comes after the Word If, muſt be your firſt Number, which is here 2; then the Demand, what coſt? muſt be your third Number, which is 8 Yards; and whatever Anſwer your Queſtion has, it will always be of the ſame Name of your ſecond or middle Number— Thus, becauſe 4*s.* is your middle Number, your Anſwer will be in Money; therefore the Sum will ſtand or be ſtated thus,

Yds,

Yds. s. Yds.
If 2 coſt 4 what coſt 8 *Anſ.* 16*s.*

RULE 3.

After the Queſtion is ſtated as above, and the firſt and third Number made alike in Name; then multiply your ſecond Number by the Third, or the Third by the Second, and divide by the Firſt, and the Quotient will be the Anſwer, or fourth Number, *viz.* 16*s.*

See the Work.

Yds. *s.* Yds.
If 2 —— 4 —— 8
8

2)32

16*s. Anſ.*

N. B. All Queſtions in this Rule are ſolved in the ſame Manner; I ſhall therefore proceed to ſhew you how theſe 4 Numbers, *viz.* 2, 4, 8 and 16, are in Proportion to each other; for the right underſtanding of this will enable you to ſolve all Queſtions in this Rule without Exception.

A PROOF *of the Rule of* PROPORTION.

1. Let the Numbers be 2, 4, 8 and 16, as before. Then as 2 : 4 :: 8 : 16.

That is, as the 1ſt is to the 2d, ſo is the 3d to the 4th; for the firſt Number 2, multiplied by the 4th Number 16, is equal to the 2d Number 4, multiplied by the 3d Number 8: Thus 2 × 16 = 32 and 4 × 8 = 32.

In a Word, when 4 Numbers are thus in proportion to each other, the two extreme Numbers multiplied together, are equal to the two middle Numbers multiplied together.

Theſe Numbers will be proportionable to each other

other in a Variety of other Reſpects. For the 1ſt is to the 3d as the 2d is to the 4th: Thus 2 : 8 :: 4 : 16. Again, the 3d is to the 1ſt as the 4th is to the 2d: for 8 : 2 :: 16 : 4. Still further, the 2d is to the 1ſt as the 4th is to the 3d: for 4 : 2 :: 16 : 8. Moreover the 4th is to the 3d as the 2d is to the 1ſt: for 16 : 8 :: 4 : 2. Again, the 4th is to the 2d as the 3d is to the 1ſt; for 16 : 4 :: 8 : 2. Once more, the 3d is to the 4th as the 1ſt is to the 2d: for 8 : 16 :: 2 : 4. In like Manner the 2d is to the 4th as the 1ſt is to the 3d: for 4 : 16 :: 2 : 8. Alſo, the 1ſt added to the 2d, is to the 2d as the 3d added to the 4th is to the 4th: for 2 + 4 : 4 :: 8 + 16 : 16. Laſtly, the 1ſt ſubtracted from the 2d is to the 2d, as the 3d ſubtracted from the 4th is to the 4th: for 4 — 2 : 4 :: 16 — 8 : 16.

Thus you ſee in what a great Variety of Ways the above Numbers are proportionable to each other; for that they are ſo appears evidently from this, that if you multiply the two extreme Numbers together, and the two middle Numbers together, you will always find their Products to be exactly equal. The ſame Relation will hold among all other proportionable Numbers.

You may likewiſe further obſerve, that the 4th divided by the 2d is equal to the 3d divided by the firſt: thus, 16 ÷ 4 is = 8 ÷ 2 = 4; and alſo that the 4th divided by the 3d, is equal to the 2d divided by the 1ſt.— Thus, 16 ÷ 8 is = 4 ÷ 2 = 2.

Sch. *I ſee all this very plainly, and it appears to me to be extremely natural and eaſy.*

Maſt. Then I ſhall give you a ſufficient Number of Examples for Exerciſe, and if you attend to the foregoing Rules, you will not be at a loſs to underſtand them, and the Manner how to work them.

EXAMPLES *in ſingle Stating.*

1. If 5 Ells coſt 17 *s.* what coſt 25 Ells? *Anſ.* 4 *l.* 5 *s.*
2. If three Pounds of Tobacco coſt 3 *s.* 6 *d.* what coſt 27 Pounds? *Anſ.* 1 *l.* 11 *s.* 6 *d.*

3. If

3. If 1 Yard coſt 2*s.* 3*d.* what coſt 127 Yards? *Anſ.* 14*l.* 5*s.* 9*d.*

4. If I ſpend five Farthings a Day, how much is that at the Year's end? *Anſ.* 1*l.* 18*s.* 0*d.* $\frac{1}{4}$.

5. If 1 Pound of Sugar coſt 9 Pence, what coſt 4 Cwt. 1 qr. 14 lb? *Anſ.* 18*l.* 7*s.* 6*d.*

6. If 4 Cwt. 1 qr. 14 lb. of Sugar coſt 18*l.* 7*s.* 6*d.* what coſt 1 lb? *Anſ.* 9*d.*

7. If 1 Buſhel of Coals coſt 10*d.* $\frac{1}{2}$, what is that per Chaldron? *Anſ.* 1*l.* 11*s.* 6*d.*

8. If 5 Chaldron of Coals coſt 7*l.* 17*s.* 6*d.* what coſt 1 Buſhel? *Anſ.* 10*d.* $\frac{1}{2}$.

9. At 4*s.* 6*d.* per Buſhel, what coſt 20 Quarters, *viz.* 4 Loads? *Anſ.* 36*l.*

10. If 20 Quarters of Malt coſt 36*l.* what is the Price of 1 Buſhel? *Anſ.* 4*s.* 6*d.*

11. Bought a ſilver Tankard and Pint Mug, which weighed together 4 lb. 2 oz. they both coſt me 14*l.* 7*s.* 6*d.* I demand what they coſt per Ounce? *Anſ.* 5*s.* 9*d.*

12. If I have an Income of 600*l.* a Year, what is it per Day? *Anſ.* 1*l.* 12*s.* 10*d.* $\frac{1}{2}$. $\frac{30}{365}$.

13. If a Pint of Wine coſt 10*d.* what coſt three Pipes or 6 Hogſheads? *Anſ.* 126*l.*

14. What coſt 5 Pieces of Iriſh Cloth, each 24 Yards long, at 2*s.* per Yard? *Anſ.* 12*l.*

15. Bought a Parcel of Holland, which coſt me 33*l.* and gave after the Rate of 7*s.* 6*d.* per Yard for it, I demand the Quantity? *Anſ.* 88 Yards.

16. If 3 Cwt. of Cheeſe coſt me 5*l.* 12*s.* what is that per Pound? *Anſ.* 4*d.* per lb.

17. Bought as many Candles at 7*d.* per Pound as coſt me a 11*l.* 4*s.* I demand how many Dozen there were? *Anſ.* 32 Dozen.

18. Bought 3 Bags of Hops which weighed 518 lb. and coſt me 8*l.* 12*s.* 8*d.* what did they coſt per lb? *Anſ.* 4*d.* per lb.

19. Bought 415 lb. of Green Tea, for 332*l.* I demand what it coſt per Pound? *Anſ.* 16*s.* per lb.

20. Bought 12 Pieces of Cloth, containing 320 Yards,

Yards, which coſt me 20*l.* what is that per Yard?

Anſ. 15*d.* per Yard.

21. Bought a Cwt. of Tea, which coſt me 30 Guineas, what does it ſtand me in per Pound?

Anſ. 5*s.* 7*d.* ½ per lb.

22. I ſold 189 oz. 14 dwts. 10 grs. of Silver, at the Rate of 7*s.* 9*d.* ½ per Ounce, what comes it to?

Anſ. 73*l.* 18*s.* 2*d.* ¾.

23. A Gentleman has an Eſtate of 251*l.* 12*s.* 6*d.* per Annum; what may he allow himſelf to ſpend every Day, ſo as to lay up every Year 60*l.* out of his Income?

Anſ. Half a Guinea a Day.

24. A Plumber bought 9 Cwt. of Lead, which coſt him 6 Guineas, I demand what it coſt per lb? *Anſ.* 1*d.* ½.

55. A Hop Merchant bought 2 Bags of Hops, each weighing 1 Cwt. 2 qrs. 10 lb. for which he gave 8 Guineas, and ſold them by Retail in his Shop at 7*d.* ½ per Pound, what did he gain or loſe?

Anſ. He gained 2*l.* 14*s.* 6*d.*

26. A Grocer bought an equal Quantity of Sugar, Tea, and Tobacco, for 704*l.* 3*s.* 4*d.* he gave 10*d.* ½ per Pound for the Sugar, 5*s.* 9*d.* per Pound for the Tea, and 20*d.* ½ per Pound for the Tobacco. I demand how many lb. he had of each Sort? *Anſ.* 1690 lb. of each.

27. What is the Intereſt of 654*l.* 8*s.* 4*d.* for 1 Year, at 5*l.* per Cent? *Anſ.* 32*l.* 14*s.* 5*d.*

28. What is the Intereſt of 1750*l.* 13*s.* 6*d.* ½ for 1 Year at 4*l.* per Cent? *Anſ.* 70*l.* and 6*d.* ½

29. A Woollen-Draper bought 4 Packs of Broad Cloth, each Pack containing 3 Parcels, each Parcel 7 Pieces, and each Piece 35 Yards long, and gave after the Rate of 13*s.* 4*d.* per Yard. I demand what the Whole coſt? *Anſ.* 1960*l.*

30. A Merchant bought 4 Cheſts of Cambrick, each Cheſt contained 3 Parcels, each Parcel 7 Pieces, and each Piece was 17 ½ Yards long, for which he gave 980*l.* I demand what it coſt him per Yard?

Anſ. 13*s.* 4*d.* per Yard.

31. If 1 Ell *Engliſh* of Holland coſt 5*s.* 3*d.* what coſt 340 Yards?

N. B. Bring

N. B. Bring the firſt Number into Quarters, and 340 Yards into Quarters, and after they are of one Name proceed as before, and you'll find the Anſwer 71*l.* 8*s.*

32. A Cheeſemonger bought 650 Cheeſes, weighing one with another 10lb. each, which coſt him 80 Guineas, now he ſold them by Retail in his Shop for 3*d.* ½ per lb. I demand what he gained or loſt by them?

Anſ. He gained 10*l.* 15*s.* 10*d.*

33. A Tobacconiſt ſent abroad 20 Hogſheads of Tobacco, each weighing 11 Cwt. 3 qrs. and ſold them at the Rate of 7*l.* 10*s.* per Cwt. his Correſpondent remitted him in Part of Payment 1500 Guineas, I demand the Balance? *Anſ.* 187*l.* 10*s.*

34. Two Perſons walking together till they came to a very high Steeple, one ſays to the other, I wonder how many Yards high it is? ſays his Companion, I'll ſoon tell you: He then ſet up his walking Stick, which was 1 Yard 9 Inches long, and the Sun ſhining bright, he meaſured the Shade of the Stick which was 5 Yards long; he alſo meaſured the Shadow of the Steeple, and found it 172 Yards long. I demand the Height of the Steeple? *Anſ.* 43 Yards.

35. Bought 12 Rolls of Cloth, each containing 36 Ells, which coſt me 45*l.* I demand how many Yards there were in all, and what the Cloth coſt per Yard?

Anſ. There were 540 Yards, which coſt 20*d.* a Yard.

36. A Merchant becomes a Bankrupt, and his Debts amount to 8760*l.* 10*s.* but all his Effects and Book Debts amount to no more than 5475*l.* 6*s.* 3*d.* what will this enable him to pay in the Pound?

Anſ. 12*s.* 6*d.*

37. A Perſon borrowed of his Friend 1000*l.* and ſometime after was obliged to leave off Trade; a Compoſition was made of 12*s.* 6*d.* in the Pound, what did his Friend receive for his Debt? *Anſ.* 625*l.*

38. A Merchant bought a Quantity of Holland, which coſt him 192*l.* 4*s.* he gave for it after the Rate of 7*s.* 9*d.* per Yard. I demand how many Ells there were?

Anſ.

Anſ. 396⅔ Ells.

39. A Wine Cooper imported 18 Pipes of Wine, (each 126 Gall.) which coſt him at firſt Purchaſe 149*l.* 10*s.* 6*d.* the Freight of it coſt him 33*l.* 12*s.* Cuſtoms 61*l.* 1*s.* Loading, Unloading, Carts, and Porters 17*l.* 6*s.* 6*d.* I demand what this Wine ſtood him in per Gallon?

Anſ. 5*s.* 10*d.*

If you give due Attention you will be able to do any Thing that has only a ſingle Stating in the Queſtion.

Sch. *I am highly obliged to you, and you may depend upon my beſt Endeavours; but as you ſay I ſhall be able to do any Sum that requires but one Stating, pray what am I to do with ſuch Queſtions as require two or more Statings.*

Maſt. If you conſider the true Nature of the Queſtion propoſed, by obſerving what is given, and what is required, you will ſoon underſtand the Manner of the Operation, and eaſily find an Anſwer.

Sch. *I am afraid, however, I cannot ſolve ſuch Queſtions ſo eaſily as you imagine: be ſo good therefore as to indulge me with two or three Examples, and inſtruct me in the Manner of working the firſt of them; I'll aſk no more.*

Maſt. My Deſire, you know, is to improve you, and as you are ſo deſirous of it, you ſhall not want for Inſtruction.

EXAMPLES, *requiring more than one Stating.*

1. How many Dozen of Pounds of Candles at 7*s.* 6*d.* per Dozen, may I have for 4C. 3qrs. 14lb. of Tallow, at 5*d.* per lb.

Anſ. 30⅓ Dozen, that is 30 Dozen and 4 Candles.

N. B. Now to perform all ſuch Queſtions as this, obſerve, that one Part is poſitive or done in effect, and the other is required, and this demands your principal Attention: Thus you are told poſitively, that there is 4 cwt. 3 qrs. 14 lb. of Tallow ſold or delivered at 5 d. per lb. Therefore for your firſt Stating ſay,

If 1lb. coſt 5*d.* what coſt 4cwt. 3qrs. 14lb.

Anſ. 11*l.* 7*s.* 6*d.*

Then, if 7*s.* 6*d.* buy 1 Dozen, what will 11*l.* 7*s.* 6*d.* buy?

Anſ. $30\frac{30}{90}$ Dozen or $30\frac{1}{3}$ Dozen which is 30 Dozen and 4 over.

Sch. *I heartily thank you; now pleaſe to leave me another Example or two for Trial?*

Maſt. I will.

2. Bought a Ton of Iron and Steel (there being in Number 130 Bars) which coſt me 29*l.* 3*s.* 4*d.* there were 70 Bars of Steel which weighed each 8 lb. and coſt 5*d.* per lb. I demand what the Iron and Steel weighed each? what they coſt ſeparately? what the Iron coſt per lb. and what each Bar weighed one with another?

Anſ. There was 15 cwt. of Iron, and 5 cwt. of Steel, the Iron coſt 17*l.* 10*s.* and the Steel coſt 11*l.* 13*s.* 4*d.* and each Bar of Iron weighed 28 lb. and coſt 2*d.* $\frac{1}{2}$ per lb.

3. How many Pieces of Linen, each 12 Yards long, and 14*d.* per Yard, may I have for 12 cwt. 3 qrs. 21 lb. of any Commodity at 20*d.* per lb.

Anſ. $172\frac{1}{2}$ Pieces.

4. A Draper bought a Quantity of Fuſtian and Shalloon, which coſt him 72*l.* there were 240 Yards of Fuſtian, at 3*s.* 6*d.* per Yard, and he had 3 Yards of Shalloon to every 2 Yards of Fuſtian. I demand how many Yards of Shalloon he had, what it coſt in all, and what it coſt per Yard?

Anſ. There were 360 Yards of Shalloon, which coſt 30*l.* and coſt 20*d.* per Yard.

Sch. *I am obliged to you, Sir, pray what comes next?*

Maſt. Another uſeful Rule.

SECT. VIII.

The SINGLE RULE of THREE INVERSE.

Sch. *WHAT do you mean by the* Rule of Three inverſe?

Maſt. It is the *Reverſe* of the Rule of Three Direct, and has 3 Numbers given to find a 4th.

Sch.

Sch. *How is this Rule the reverſe of the Rule of* Three Direct?

Maſt. Becauſe in the Rule of Three Direct, you multiplied your 2d Number by your 3d, and divide by your 1ſt. Here, on the contrary, you muſt multiply your 1ſt Number by your 2d, and divide by your 3d. — An Example or two will ſoon make it plain to you.

EXAMPLES.

1. How many Yards of Shalloon, 3 qrs. wide, will line 9 Yards of Cloth, 5 qrs. wide?

qrs.	yds.	qrs.
If 5	9	3
	5	
	3)45	
	Anſ. 15 Yards.	

2. How many Yards, Yard-wide, will line 30 Yards of Cloth 6 qrs. wide? *Anſ.* 45 Yards.

3. How many Yards of Tapeſtry, or other Stuff that is Yard-wide, will cover a Floor 16 Feet long and 15 Feet wide. *Anſ.* 18 Feet, or 26 Yards 2 Feet.

4. If 8 Men build a Houſe in 48 Days, how many will build the ſame, or one of the ſame Sort in 16 Days?

Anſ. 24 Men.

5. A running Footman performs a Journey in 15 Days, when the Days are 8 Hours long, in how many Days will he do the ſame, when the Days are 12 Hours long?

Anſ. 10 Days.

6. There were 1200 Soldiers in a Garriſon, who had Proviſions only for ſix Weeks; how many muſt be ſent away, and how many ought to ſtay that the ſame may laſt them 18 Weeks?

Anſ. 400 may ſtay, and 800 depart.

7. A Perſon lent me 1000*l.* for 9 Months, on Condition I would lend him a Sum on Occaſion: he afterwards borrowed of me 750*l.* I demand for how long a

Time I ought to lend it him to return the Kindneſs he had done me? *Anſ.* 12 Months.

8. A Regiment of Soldiers, conſiſting of 900, are to have new Coats, each containing 3 yds. 2 qrs. of Cloth 5 qrs. wide, and they are to be lined with Shalloon, which is 3 qrs. wide, I demand how many Yards of Cloth there are in all for their Coats, and how many Yards of Shalloon it will take to line them?

Anſ. The Quantity of Cloth is 3150 Yards, and it will take 5250 Yards of Shalloon to line them.

9. If for 30 *s.* I have 9 C. 3 qrs. 21 lb. carried 50 Miles, how many Pounds ought I to have carried 150 Miles for the ſame Money?

Anſ. 3 C. 1 qr. 7 lb. or 371 lb.

10. If when Flour is ſold for 6 *s.* 8 *d.* per Buſhel, a Three-penny Loaf weighs 2 lb. 6 oz. how much ought it to weigh when the ſame Sort of Flour is ſold for 5 *s.* per Buſhel? *Anſ.* 3 lb. 2 oz. and $\frac{2}{3}$ of an Ounce.

SECT. IX.

The Double RULE of THREE DIRECT, AND The Double RULE of THREE INVERSE.

Sch. *WHAT do you mean by the* double Rule of Three Direct, *and the* double Rule of Three Inverſe?

Maſt. When 5 Numbers are given in order to find a 6th.

Sch. *How is this Rule perform'd?*

Maſt. Either by two Statings or by one.

Sch. *How is it perform'd by two Statings?*

Maſt. When the Proportion is *direct*, it is perform'd by two Operations in the ſingle Rule of Three Direct. When the Proportion is *inverſe*, it is performed by two Oper-

Operations, one of which is *direct*, and the other *inverse*; for they are never both *inverse*.

An EXAMPLE *of two Statings, in the Double Rule of Three Direct.*

If 100 *l.* in 12 Months gain 5 *l.* Intereſt, what will 80 *l.* gain in 9 Months?

	l.	*l.*	*l.*	
Firſt, if	100	5	80	*Anſ.* 4 *l.* Then,
	Mths.	*l.*	*Mths.*	
If	12	4	9	*Anſ.* 3 *l.*

And thus for any other Queſtion.

An EXAMPLE *of two Statings, in the Double Rule of Three Inverſe.*

If 100 *l.* Principal in 12 Months gain 5 *l.* Intereſt, what Principal will gain 3 *l.* in 9 Months?

Firſt, Direct.

	l.	*l.*	*l.*	
If	5	100	3	*Anſ.* 60 *l.* Then,

Inverſe.

	Mths.	*l.*	*Mths.*	
If	12	60	9	*Anſ.* 80 *l.* Principal.

Sch. *How is this Rule perform'd by one Stating?*

Maſt. When the Proportion is direct, the 6th Number (or Number required) muſt bear the ſame Proportion to the 4th and 5th multiplied together, as the 3d Number bears to the 1ſt and 2d multiplied together.

In ſtating the Queſtion, therefore, obſerve the following

RULE.

Firſt, make your 1ſt and 4th Numbers of the ſame

Name or Denomination, as alſo your 2d and your 5th; and let the middle or 3d Number be of the ſame Name that your Anſwer is required in. Then,

2dly. Multiply by your 1ſt and 2d together, for a Diviſor, and your 3d, 4th, and 5th together, for a Dividend, and the Quotient will be the Anſwer in the ſame Name your middle or 3d Number is in.

Or,

Multiply your 1ſt and 2d Numbers together, for a new firſt Number, and your 4th and 5th for a new 3d Number; ſo will the 5 Numbers be reduced to 3, and will become a plain Queſtion in the *Single Rule of Three Direct*, and muſt be proceeded with accordingly.

Examples.

1. If 100*l.* in 12 Months gain 5*l.* Intereſt, what will 80*l.* gain in 9 Months?

The Work.

l.	*m.*	*l.*	*l.*	*m.*
If 100	12	5	80	9
12				80
1200		5		720
				5
				12|00)36|00
				3*l.* *Anſ.*

2. If 20 Workmen build 40 Stands, or Booths, in 30 Days, how many Booths, or Stands, will 80 Men build in 15 Days? *Anſ.* 80 Booths.

3. Suppoſe it coſt me 10*l.* a Week for the Wages of 8 Men, what will it coſt me for 40 Men, having the ſame Pay, for 7 Weeks? *Anſ.* 350*l.*

4. If

4. If a Regiment, conſiſting of 900 Soldiers, eat up 300 Quarters of Wheat in 150 Days; I demand how many Quarters 7200 Soldiers will in 50 Days, at the ſame Rate? *Anſ.* 800 Quarters.

5. A General of an Army has 500 Horſes, which in 30 Days, one with another, eat 50 Quintals of Oats: but his Enemy increaſing in Numbers, he was obliged to ſend for a Reinforcement of 3000 more Horſes, and found that he muſt provide Proviſion for the whole for full 90 Days; I demand how many Quintals they will eat in that Time?

Anſ. 1050 Quintals.

INVERSE PROPORTION.

When the Proportion is Inverſe, the 6th Number muſt bear the ſame Proportion to the 4th and 5th as the 1ſt does to the 2d and 3d; and you may ſolve the Queſtion by making it a plain one in the *Single Rule of Three Inverſe*, as follows.

RULE I.

Firſt ſet the two conditional Numbers one over the other, then place your middle in Order, and ſet after this the two Numbers, one over the other, in which the Demand lies.—— Then multiply the lower Number of the 1ſt, by the upper Number of the 2d, for a new 1ſt Number, and upper Number of the 1ſt by the lower Number of the 2d, for a new 3d Number; then proceed as in the *Single Rule of Three Inverſe*, and you will have the Anſwer required.

EXAMPLES.

If 100*l.* in 12 Months gain 5*l.* Intereſt, what Principal will gain 3*l.* in 9 Months? Work,

$$\frac{5l.}{12\ \text{Mths.}} \qquad \frac{3l.}{9\ \text{Mths.}}$$

Now $12 + 3 = 36$, and $5 + 9 = 45$; then,

If 36 —— 100 —— 45 Inverſe. *Anſ.* 80*l.*

Or

Or Thus:

Having ranked the 5 Numbers in due Order, as the Condition of the Question requires: Then,

RULE 2.

Multiply your 2d and 4th together, for a 1st Number, and your 1st and 5th together for a 3d Number, and proceed as before. Thus,

l. *m.* *l.* *l.* *m.*
If 5 — 12 — 100 3 — 9. First, 12 × 3 = 36, 1st Number; 5 × 9 = 45, 3d Number, as before. Do you understand it? if not, look it over again carefully.

2 If 20 Men in 30 Days build 40 Sheds, or Booths, how many Men will build 80 Booths in 15 Days?

Anſ. 80 Men.

SECT. X.

Of TARE and TRETT.

Sch. *WHAT do you mean by the Rule of* Tare and Trett?

Maſt. It is properly no Rule of itſelf; but is only the *Rule of Three Direct*, uſed with the Rule of Subtraction, by taking out Allowances for the Waſte of Commodities, &c.

Sch. *Pleaſe to tell me what theſe Allowances are, what they are called, and how taken off?*

Maſt. I will: But it is neceſſary to inform you, that the Groſs Weight comes firſt of all, and the Allowances follow after, in the following Order.

1. *Groſs*, or *Groſs Weight*, is the whole Weight of the Caſk, Barrel, or Bag, with the Commodity and all contained therein.

2. *Tare* is the Allowance made for the weight of the Caſk, or Bag, which is weighed by the Seller before he puts in the Commodity, and by the Buyer after he takes it out. Thus, ſuppoſe a Hogſhead of Sugar ſhould

ſhould weigh 9 cwt. 3 qrs. 14 lb. Groſs, viz. Hogſhead and all; and when it is emptied, the Caſk itſelf only ſhould weigh 3 qr. 14 lb.—This laſt is called the *Tare*: then follows,

3. *Neat Weight*, that is when the *Tare* is taken out of, or ſubtracted from the *Groſs*, the Remainder will be the *Neat Weight*: Thus, as was ſaid before, 3 qrs. 14 lb. *Tare*, taken out of 9 cwt. 3 qrs. 14 lb. *Groſs*, there will remain 9 cwt. *Neat-Weight*.

4. *Trett* is an Allowance of 4 lb. in every 104 lb. that is, 1 lb. in every 26 lb. therefore take the *Tare* firſt out of the *Groſs*, and reduce this laſt into Pounds, and call them Suttle; then divide the Pounds by 26, and the Quotient will be the *Trett* Pounds; which being likewiſe taken out, the Remainder is the *Neat* Weight.

N. B. There are other Allowances, ſuch as *Clough*, or *Cloff*, &c. but theſe are ſeldom uſed, except on very extraordinary Occaſions.

EXAMPLES.

1. Bought 3 Hhds. of Sugar, each weighing 14 cwt. 2 qrs. 14 lb. Tare of each 2 qrs. 11 lb. I demand the neat Weight?

Anſ. 42 cwt. 9 lb.

2. A Grocer bought 4 Hhds of Sugar: (No. 1.) weighed Groſs 10 cwt. 3 qrs. 7 lb. (No. 2.) 13 cwt. 2 qrs. (No. 3.) 15 cwt. 1 qr. 11 lb. and (No. 4.) 13 cwt. 1 qr. 26 lb. Tare of the whole 5 cwt. 1 qr. 2 lb. Trett 4 lb. for every 104, (or 1 lb. every 26 lb.) what is the Neat Weight, and what come they to, at two Guineas *per* Cwt.?

Anſ. 5156 lb. Neat Weight, and the Price is 964*l.* 13 *s.* 6 *d.*

*** Add the 4 Hhds. together, you will find the Groſs 53 cwt. and 16 lb. take the Tare out of this, and you will find it 47 cwt. 3 qrs. and 14 lb. Suttle, which is 5362 lb. Suttle. This, divided by 26 gives 206 lb. Trett; which taken from the 5362 lb. Suttle, leaves 5156 lb. Neat; which at 2 Guineas *per* cwt. you will find

find coſt 96*l.* 13*s.* 6*d.*—— From this Example you may do any other by Care and Obſervation.

Sch. *I return you Thanks, Sir; I will do my beſt, you may depend upon it.*

Maſt. Then you will be qualified for the Rule of *Practice.*

SECT. XI.

Of PRACTICE.

Sch. *WHAT do you mean by* Practice?

Maſt. Practice is ſo called, from its general Uſe in *Practice*, and is ſo contrived, that thoſe who are Maſters of it, can caſt up, or tell what any Commodity comes to, in a very ſhort Time, without the Trouble of reducing the Price into its loweſt Terms, as in the *Rule of Three Direct.*

Sch. *How is it perform'd?*

Maſt. By *Multiplication* and *Diviſion*, or by *Diviſion* only.

Sch. *Pray inform me how?*

Maſt. I will; but you muſt firſt of all learn the following Tables perfectly.

TABLE I.

Of the aliquot or even Parts of a Pound Sterling.

s.	*d.*	*Parts.*	
10	0	$\frac{1}{2}$	*of a Pound Sterling.*
6	8	$\frac{1}{3}$	
5	0	$\frac{1}{4}$	
4	0	$\frac{1}{5}$	
3	4	$\frac{1}{6}$	
2	6	$\frac{1}{8}$	
2	0	$\frac{1}{10}$	
1	8	$\frac{1}{12}$	
1	3	$\frac{1}{16}$	
1	0	$\frac{1}{20}$	

TABLE II.

Of the even Parts of a Shilling.

Pence		
6	is $\frac{1}{2}$	*of a Shilling.*
4	$\frac{1}{3}$	
3	$\frac{1}{4}$	
2	$\frac{1}{6}$	
1½	$\frac{1}{8}$	
1	$\frac{1}{12}$	

EXAM-

EXAMPLES.

CASE I.

When the Price of the Integer is Farthings, then reduce them into Pence, Shillings, and Pounds, as you did in *Reduction*.

I ſhall work a few Queſtions at large, and the reſt I ſhall leave for your Practice.

		lb.
$\frac{1}{4}$	$\frac{1}{4}$	1765 at $\frac{1}{4}$ *per lb.*
1*d*	$\frac{1}{12}$	441 - $\frac{1}{4}$
	2|0	3| 6 9*d.*
	£.	1 16 9*d.* $\frac{1}{4}$ *Anſ.*

		lb.
$\frac{1}{2}$	$\frac{1}{2}$	1765 at $\frac{1}{2}$ *per lb.*
1*d*	$\frac{1}{12}$	882 - $\frac{1}{2}$
	2|0	7|3 - 6
	£.	3 13 6$\frac{1}{2}$ *Anſ.*

		lb.
		1765 at $\frac{3}{4}$ *per lb.**
		3
$\frac{1}{4}$	$\frac{1}{4}$	5295 Farthings
1*d*	$\frac{1}{12}$	1323 — $\frac{3}{4}$
	2|0	11|0 — 3 *d.*
	£.	5 10 3$\frac{3}{4}$ *Anſ.*

		lb.
1*d*	$\frac{1}{12}$	1765 at 1 *d. per lb.*
	2|0	14|7 — 1
	£.	7 17 1*d. Anſ.*

* *N. B.* The third Example may alſo be done by dividing by $\frac{1}{8}$, $\frac{1}{2}$, and $\frac{1}{20}$, becauſe $\frac{3}{4}$ is $\frac{1}{8}$ of 6 Pence; then divide by $\frac{1}{2}$, it will be Shillings, and by $\frac{1}{20}$ it will be Pounds Sterling. —— Always remember every Remainder is of the ſame Name as the Dividend.

1*d.*

1d	1/12	1765 at 1¼d.
1/4	1/4	147 - 1d.
		36 - 9¼
	2|0	18|3-10¼
	£.	9 3 10¼ *Anſ.*

2d	1/6	1765 at 2½d.
1/2	1/4	294 - 2
		73 - 6½
	2|0	36|7 8½
	£.	18 7 8½ *Anſ.*

3d	1/4	1765 at 3¾d.
3/4	1/4	441 - 3d.
		110 - 3¾
	2|0	55|1 6¾
	£.	27 11 6¾ *Anſ.*

4d	1/3	1765 at 5¼d.
1	3/4	588 - 4d.
1/4	1/4	147 - 1
		36 - 9¼
	2|0	77|2 2¼
	£.	38 12 2¼ *Anſ.*

4d	1/3	1765 at 5½d.
1	3/4	588 - 4d.
1/2	1/2	147 - 1
		73 - 6½
	2|0	80|8 11½
	£.	20 8 11½ *Anſ.*

6d	1/2	1765 at 10½d.
3	1/2	882 - 6
1½	1/2	441 - 3
		220 - 7½
	2|0	154|4 - 4½
	£.	77-4 - 4½

6d	1/2	1765 at 11¼d.
3	1/2	882 - 6
1½	1/2	441 - 3
3/4	1/2	220 - 7½
		110 - 3¾
	2|0	165|4 8¼
	£.	82 14 8¼

N. B.

N. B. These Questions may be done shorter, but I have taken the more Parts, to make the Division more easy and the Process more natural; and if they are well attended to, you will soon arrive at the Knowledge of every Thing of this Sort.

QUESTIONS *for* TRIAL.

4*d*	$\frac{1}{3}$	1753 at $5\frac{3}{4}d.$
1	$\frac{1}{4}$	
$\frac{1}{2}$	$\frac{1}{2}$	
$\frac{1}{4}$	$\frac{1}{2}$	
2|0		83 | 9*s.* $11\frac{3}{4}$
£.		41 19 $11\frac{3}{4}$ *Anſ.*
3*d*	$\frac{1}{4}$	1753 at $6\frac{1}{4}d.$
3	$\frac{1}{4}$	
$\frac{1}{4}$	$\frac{1}{2}$	
2|0		91 | 3*s.* $-\frac{1}{4}$
£.		45 13*s.* $-\frac{1}{4}$ *Anſ.*

4*d*	$\frac{1}{3}$	1765 at $7\frac{3}{4}d.$
2	$\frac{1}{2}$	
1	$\frac{1}{2}$	
$\frac{1}{2}$	$\frac{1}{2}$	
$\frac{1}{4}$	$\frac{1}{2}$	
2|0		113 | 2*s.* $1\frac{3}{4}d.$
£.		56 12 $1\frac{3}{4}$ *Anſ.*

Or thus rather.

6*d*	$\frac{1}{2}$	1753
$1\frac{1}{2}$	$\frac{1}{4}$	
$\frac{1}{4}$	$\frac{1}{6}$	
2|0		113 | 2*s.* $1\frac{3}{4}d.$
£.		56 12 $1\frac{3}{4}$ *Anſ.*

4d	1/3	1753 at 8½d.
4	1/3	
½	1/8	
2|0		124 | 1s. 8½
£.		62 1 8½
6d	½	1753 at 9¾d.
3	½	
¼	¼	
2|0		142 | 4s. 3¾d.
£.		71 4 3¾ Anſ.

6d	½	1753 at 10½d.
3	½	
1½	½	
2|0		153 | 3s. 10½
£.		76 13 10½
6d	½	1753 at 11¼d.
3	½	
1½	½	
¾	¼	
2|0		164 | 3s. 5¼d.
£.		82 3 5¼

CASE 2.

When the Price is above 1 Shilling and under 2 Shillings, then let the Number, or Quantity given, ſtand without drawing any Line under it, and proceed with the odd Pence and Farthings, as before.

Thus 1765 Yards, at 12*d.* per Yard, is 1765*s.* or 88*l.* 5*s.* Therefore ſuppoſe it were 1765 at 15¾*d.* I leave 1765 ſtanding, which are Shillings, and work only with the odd 3¾*d.* as before.

See EXAMPLES.

3d	¼	1765 at 15¾d.
¾	¼	441 - 3
		110 - 3¾
2|0		231 | 6s. 6¾
£.		115 16 6¾ Anſ.

4d	⅓	1765 at 17½d.
1	¼	
½	½	
2|0		257 | 3s. 11½
£.		128 13 11½

6d.

6	½	1765 at 22½ d.	
3	½		
	½		
2|0		330 | 9 s.	4½ d.
£.		165	9 4½

6d	½	1765 at 23¼ d.	
3	½		
1½	½		
¾	½		
2|0		341 | 9 s.	8¼ d.
£.		170	19 8¼

CASE 3.

When the Price given is above 2 Shillings, and under 20 Shillings, then multiply by the Shillings, and take the Parts of the Pence and Farthings, as in the laſt Caſes.

EXAMPLES.

* 575 at 3 s. 9¾ d.
3

*6d	½	1725	
3	½	287 - 6 d.	
¾	¼	143 - 9	
		35 - 11¼	
2|0		219 | 2	2¼
£.		109	12 2¼ *Anſ.*

*575 at 11 s. 5¼ d.
11

*4d	⅓	5325	
1	¼	191 - 8 d.	
¼	¼	47 - 11	
		11 - 11¾	
2|0		657 | 6 -	6¾
£.		328	16 6¾

** *N. B.* When I ſay 6*d.* is the ½ I don't take the ½ of 1725, for that is the Price of 3 Shillings; but I take the ½ of the Top Number 575. I do the ſame in Example 2, for 4*d.* is ⅓ of a Shilling, not of 11 Shillings.

475 at 15s. 10½d.
15

3		
£½	½	
	½	
	½	
2|0	754 | 0 -	7½d.
£.	377 —	7½d.

397 at 18s. 3d.¾.
18

3d	¼	
¾	¼	
2|0	727 | 0 -	-¾
£.	363 10 -	-¾

CASE 4.

When the given Price is Pounds, Shillings, Pence, and Farthings, then multiply by the Pounds, and take the Parts of a Pound by Table I. and divide the given Number thereby; that is, divide by the Shillings, Pence, and Farthings, according to their true Parts.

EXAMPLES.

*135 at 3l. 15s. 6d.
3

10s	405			
½	67	10s.		
½	33	15		
1/10	3	7	6d.	
£.	509	12	6	Anſ.

287 at 5l. 18s. 4d.
5

	1435			
5s. ½	143	10		
2 ½	71	15		
6d. 1/10	35	17	6	
10d. ⅓	11	19	2	
£	1698	1	8	Anſ.

* Here in Example 1. I multiply by 3l. then I take the Parts of a Pound, ſaying 10s. is the ½; and I take the ½ of 135, which is 67, and one remains over, which is 1l. then I ſay the ½ of 1l. is 10s.— 2dly, Then I ſay 5s. is the ½ of 10s. and take the ½ of 67l. 10s. and that is 33l. 15s. and then I ſay 6d. is the 1/10 of 5s. and therefore I take the 1/10 of 33l. 15s. and find it to be 3l. 7s. 6d. and the Total or Anſwer is 509l. 12s. 6d.

Proceed

Proceed in the ſame Manner with the other Examples, and I hope you will find them right and ſerviceable to you.

EXAMPLES *for Trial.*

1753 Yards at 5*d.* ¾. *Anſ.* 41*l.* 19*s.* 11*d.* ¾.
3506 Ells at 7*d.* ¾. *Anſ.* 113*l.* 4*s.* 3*d.* ½.
5259 lb. at 19*d.* ½. *Anſ.* 427*l.* 5*s.* 10*d.* ½.
329 oz. at 21*d.* ½. *Anſ.* 29*l.* 9*s.* 5*d.* ½.
595 lb. at 22*d.* ½. *Anſ.* 55*l.* 15*s.* 7*d.* ½.
375 Ells at 2*s.* 8*d.* ½. *Anſ.* 50*l.* 15*s.* 7*d.* ½.
1251 Yards at 5*s.* 10*d.* *Anſ.* 364*l.* 17*s.* 6*d.*
285 cwt. at 12*s.* 9*d.* ½. *Anſ.* 182*l.* 5*s.* 7*d.* ½
370 Loads at 18*s.* 10*d.* *Anſ.* 348*l.* 8*s.* 4*d.*
225 Tons at 37*s.* 6*d.* *Anſ.* 421*l.* 17*s.* 6*d.*
185 cwt. at 3*l.* 16*s.* 9*d.* *Anſ.* 709*l.* 18*s* 9*d.*
45 hhs. at 12*l.* 18*s.* ¾. *Anſ.* 580*l.* 12*s.* 9*d.* ¾.

CASE. 5.

When the given Price is an even Number of Shillings, then multiply the given Number, or Quantity, by half the Number of Shillings; then cut off the firſt or Unit Figure, and thoſe on the left Hand will be Pounds: and then double the Figure you cut off, and it will be the Shillings.

EXAMPLES.

456 Ells at 12*s.*	248 at 16*s.*
6	8
2736	1984
Anſ. 273*l.* 12*s.*	198*l.* 8*s.*

Of WEIGHT.

Sch. *How is this perform'd?*

Maſt. By taking the even Parts of Tons and Hundred-weights, *&c.* (as you did in Money,) according to the following Table.

Table of Weight.

Even Parts of a Ton.			Even Parts of a Cwt.		
C.	qrs.		qrs.	lb.	
10	—	is $\frac{1}{2}$ of a Ton.	2	—	is $\frac{1}{2}$
5	—	is $\frac{1}{4}$	1	—	is $\frac{1}{4}$
4	—	is $\frac{1}{5}$	—	16	is $\frac{1}{7}$
2	2	is $\frac{1}{5}$	—	14	is $\frac{1}{8}$
2	—	is $\frac{1}{10}$	—	8	is $\frac{1}{14}$
1	—	is $\frac{1}{20}$	—	7	is $\frac{1}{16}$

You will remember alſo to get this Table by Heart.

Sch. *I will.*

Maſt. Then you will be fit for the following

RULE.

Multiply the firſt Denomination of the Weight by the firſt Denomination or Name of the given Price; then take the Parts of the given Price (as in the laſt Caſe) out of the Top or firſt Denomination, till you have done with all the Parts of the given Price: This done, take the even Parts of the Weight of the firſt Name and divide the given Price into ſuch Parts; after which add the whole together, and you have the Anſwer in Pounds or Shillings, according to the Price given.

Sch. *This Rule is too intricate, Sir, for me to comprehend, without an Example or two.*

Maſt. Then you ſhall have them.

		C. Q. lb.		T.C.Q.
		*5 3 14 at 2*l.* 10*s.*		14 16 1 at 8*l.* 12*s.*
		2		8
		10		
10*s.*	$\frac{1}{2}$	2 10*s.*	10*s.*	$\frac{1}{2}$
2 qrs	$\frac{1}{2}$	1 5	2	$\frac{1}{2}$
1	$\frac{1}{2}$	12 6*d.*	10 C.	$\frac{1}{2}$
14 lb	$\frac{1}{2}$	6 3	5 C.	$\frac{1}{4}$
			5 q.	
	£.	14 13 9	*£.*	127 7 9

* Here

* Here in Example 1. I multiply 5 cwt. by the Price 2*l.* and it gives 10*l.* then I ſay, 10*s.* is ½ of a Pound; therefore, as 5 cwt. at 1*l.* per Hundred is 5*l.* 5 cwt. at 10*s.* per Hundred muſt be the Half of that, viz. 2*l.* 10*s.* Now all the Hundred Weights being done, I proceed to the odd Weight, and ſay, that 2 qrs. is the Half of a Hundred Weight; therefore I take the Half of the Price per Cwt. viz 2*l.* 10*s.* and it is 1*l.* 5*s.* then I ſay, 1 qr. is the Half of 2 qrs. and take the Half of the Price of 2 qrs. and it is 12*s.* 6*d.* and laſtly, I ſay, 14 lb. is the Half of 1 qr. which is 6*s.* 3*d.* and having added all theſe together, I find the Sum or Total to be 14*l.* 13*s.* 9*d.* Proceed thus with Example 2. and you will find the Anſwer 127*l.* 7*s.* 9*d.*

More Examples.

35 cwt. 3 qrs. 10 lb. of Soap at 2*l.* 2*s.* 6*d.* per Cwt.
Anſ. 76*l.* 3*s.* 1*d.*

19 cwt. 1 qr. 21 lb. of Sugar at 2*l.* 12*s.* 8*d.* per Cwt.
Anſ. 51*l.* 3*s.* 8*d.* ½

29 cwt. 1 qr. of Tallow at 2*l.* 17*s.* per Cwt.
Anſ. 83*l.* 7*s.* 3*d.*

144 cwt. 3 qrs. 8 lb. of Hops, at 8 lb. 11*s.* 4*d.* per Cwt.
Anſ. 1240*l.* 12*s.* 8*d.* ¾.

14 Ton. 16 cwt. 3 qrs. 21 lb. at 11*l.* 13*s.* 4*d.* per Ton.
Anſ. 173*l.* 4*s.* 2*d.* ¼.

29 Ton 13 cwt. 3 qrs. 14 lb. at 5*l.* 16*s.* 8*d.* per Ton.
Anſ. 173*l.* 4*s.* 2*d.* ¼.

SECT. XII.

Of SIMPLE INTEREST, BROKERAGE, and ASSURANCES.

I. Of SIMPLE INTEREST.

Sch. *WHAT do you mean by* Simple Intereſt?

Maſt. It is an Allowance of ſo much per Cent. from the Borrower to the Lender, as an Acknowledgment

ledgment for the Favour done him in ſuffering him to make Uſe of the Money lent him for a certain Time agreed upon.

Sch. *How is this Intereſt found out?*

Maſt. It may be found out by the Rule of Three Direct, as I ſaid before.— See Queſtion the 27th and 28th in that Rule; but there is a ſhorter Way by Practice, and much eaſier, as follows.

Case 1.

When the Rate per Cent. is Pounds, then multiply the given Sum by the Rate per Cent. and cut off the firſt 2 Figures towards the right Hand in the place of Pounds, that is the Units and Tens (which is the ſame as dividing by 100) and the Figures remaining towards the left Hand, will be the intereſt of that Sum in Pounds for one Year; then multiply the two Figures you cut off by 20, and take in the Shillings, and cut off two Figures as before, and the left Hand will give the Shillings: then multiply the Remainder by 12, and by 4, taking in the odd Pence and Farthings, and cut off as before, you have the Pence and Farthings.

Examples.

1. What is the Intereſt of 475*l.* 12*s.* 6*d.* for one Year, at 5 *l.* per Cent. per Annum?

475 12 6
5

l. 23 | 78 2 6
20

s. 15 | 62
12

d. 7 | 50
4

qrs. 2 | 00

Anſ. 23*l.* 6*s.* 7*d.* ½.

2. What's

2. What's the Intereſt of 1765*l.* 10*s.* for 1 Year, at 4*l.* per Cent. *Anſ.* 70*l.* 12*s.* 4*d.* $\frac{3}{4}$.

3. A borrowed of B 1560*l.* at 4*l.* per Cent. per Annum, and paid 2 Years Intereſt for it very punctually; but B took no Care to call upon A; nor did A take Notice to pay any more Intereſt: now B died exactly 9 Years after he had lent A the Money, and in his will left to his eldeſt Son the whole Principal, and all Intereſt due upon it. I demand what Intereſt was due, and what was the Son's Fortune.

Anſ. The Intereſt due was 436*l.* 16*s.* and the whole Fortune 1996*l.* 16*s.*

Case 2.

When the Intereſt is for Years and Months, then find the Intereſt for one Year, and take the Parts for the Months, out of one Year's Intereſt, and add all the Sums together.

4. What is the Intereſt of 1765*l.* 10*s.* for 4 Years, 9 Months, at 5*l.* per Cent. per Annum. *Anſ.* 419*l.* 6*s.* 1*d.* $\frac{1}{2}$. For the Intereſt for one Year, is 88*l.* 5*s.* 6*d.* this × 4 = 353*l.* 2*s.* for four Years. Then for the odd 9 Months, ſay 6 Months is the $\frac{1}{2}$ of a Year, and take the $\frac{1}{2}$ of 88*l.* 5*s.* 6*d.* which is 44*l.* 2*s.* 9*d.* then, for the other 3 Months, take the $\frac{1}{2}$ of 44*l.* 2*s.* 9*d.* which is 22*l.* 1*s.* 4*d.* $\frac{1}{2}$. Add theſe 3 Sums together, you will find the Anſwer 419*l.* 6*s.* 1*d.* $\frac{1}{2}$.

Case 3.

When the Intereſt is for any Time leſs than a Year, find it firſt for a Year, and then take the Parts of one Year's Intereſt for the given Time.

Example.

5. What is the Intereſt of 478*l.* 15*s.* for 4 Months, at 5*l.* per Cent. per Annum? *Anſ.* 7*l.* 19*s.* 7*d.* For 1 Year is, 23*l.* 18*s.* 9*d.* and 4 Months is $\frac{1}{3}$ of a Year; therefore the 3d Part of 23*l.* 18*s.* 9*d.* is 7*l.* 19*s.* 7*d.*

Case

CASE 4.

II. INTEREST *for* DAYS.

RULE.

Bring the Principal into Pence, and multiply them by the Number of Days, and the Product of theſe two by the Rate per Cent. and this will be a Dividend; then multiply 365 by 100, and it will be a Diviſor, and the Quotient will be the Anſwer in Pence.

EXAMPLES.

6. What is the Intereſt of 240*l.* for 126 Days, at 4*l.* per Cent. *Anſ.* 795 Pence $\frac{129}{365}$, *viz.* 3*l.* 6*s.* 3*d.* $\frac{129}{365}$.

7. What is the Intereſt of 480*l.* for 120 Days, at 4*l.* per Cent. *Anſ.* 6*l.* 6*s.* 2*d.* $\frac{350}{365}$.

CASE 5.

Having the Rate per Cent. the Intereſt and Time given, to find the Principal.

RULE.

As the Intereſt of 100*l.* at the Rate and Time given is to 100*l.* ſo is the given Intereſt to the Principal required.

EXAMPLES.

8. What Principal being put to Intereſt, at 5*l.* per Cent. will in one Year produce 23*l.* 15*s.* 7*d.* $\frac{1}{2}$?
Anſ. 475*l.* 12*s.* 6*d.*

9. A Perſon had a certain Sum of Money, which was put out at the Rate of 5*l.* per Cent. and when it had continued 4 Years, 9 Months, he received for Intereſt, 419*l.* 6*s.* 1*d.* $\frac{1}{2}$, I demand the Principal?
Anſ. 1765*l.* 10*s.*

CASE 6.

Having the Amount, Rate per Cent, and Time given, to find the Principal.

RULE.

RULE.

As the Amount of 100*l.* at the Rate and Time given, is to 100*l.* ſo is the Amount given to the Principal required:

EXAMPLE.

10. What Principal being put to Intereſt at 5 per Cent. will in 6 Years amount to 1300*l.*? *Anſ.* 1000*l.*

CASE 7.

Having the Principal, Intereſt, and Rate per Cent. to tell the Time.

RULE.

Firſt, find the Intereſt for one Year; then by the Rule of Three, ſay, As 1 Year's Intereſt is to 1 Year, ſo is the Intereſt upon the Whole for the whole Time, to the Time required.

EXAMPLES.

10. A Perſon put into the Stocks 1765*l.* 10*s.* at 5*l.* per Cent. and it lay ſo long that the Intereſt amounted to 419*l.* 6*s.* 1*d.* ½; I demand the Time it was in?
Anſ. 4 Years and 9 Months.

11. In what length of Time will 1080*l.* put out at 4*l.* per Cent. be increaſed to the Sum of 1382*l.* 8*s.*
Anſ. 7 Years.

CASE 8.

Having the Principal, Amount, and Time given, to find the Rate per Cent. that it was put out at.

RULE.

As the Principal (1ſt Number) is to the Intereſt of it for the whole Time (2d Number) ſo is 100*l.* (3d Number)

Number) to the Intereſt of a 100*l.* for the ſame Time; which Intereſt divided by the Time given, gives the Rate per Cent.

EXAMPLES.

12. At what Rate per Cent. will 643*l.* 15*s.* ſix Years hence amount to the Sum of 798*l.* 5*s.*

Anſ. 4*l.* per Cent.

13. At what Rate per Cent. will 1765*l.* 10*s.* 4 Years 9 Months hence, be increaſed to the Sum of 2184*l.* 16*s.* 1*d.* ½.

Anſ. 5*l.* per Cent.

III. Of ASSURANCES or BROKERAGE.

Theſe are both performed in the ſame Manner as Intereſt: if the Rate per Cent be given in Pounds, the Anſwer will be in Pounds or Parts of a Pound; and if the Rate per Cent be given in Shillings, the Anſwer will be in Shillings.

I. ASSURANCES.

1. What is the Premium of 2000*l.* at 6*s.* per Cent.

Anſ. 120*s.* or 6*l.*

2. What is the Premium of 2300*l.* at 2*s.* 6*d.* per Cent. *Anſ.* 57*s.* 6*d.* or 2*l.* 17*s.* 6*d.*

A Ship is inſured from London to Leghorn, at 5*l.* ½ per Cent. on the Sum of 1750*l.* I demand the Premium.

Anſ. 96*l.* 5*s.*

3. A Merchant aſſured a Ship bound to the Eaſt-Indies, for 1650*l.* and the Cargo for 4100*l.* for which he paid 8*l.* ½ per Cent. and the Office, in caſe of a Loſs, was to pay 98*l.* per Cent. deducting ½ per Cent: Now the Ship was caſt away, and nothing ſaved; I demand what Sum the Merchant paid to the Office, what the Office paid to him, and what Loſs it ſuſtained?

Anſ. The Premium paid was 488*l.* 15*s.* The Money the Office paid him was 5606*l.* 16*s.* 6*d.* this — 488*l.* 15*s.* = 5118*l.* 1*s.* 6*d.* is the Money that the Office loſt by the Aſſurance.

II. Of

II. Of BROKERAGE, COMMISSION, or FACTORAGE.

This is an Allowance made to Brokers for their Trouble in finding Perſons that are ready to buy or ſell Stocks; or to Factors for their Commiſſion.

RULE.

This is done the ſame Way as Intereſt, that is, divide by 100, and take the given Parts out of that Sum: Or if it be given in Shillings and Pence, multiply by the Shillings, and take the Parts for the Pence out of the Top; then add all the Sums together, and then cut off two Figures (or, which is the ſame Thing, divide by 100) and the Figures towards the left Hand will be the Anſwer in Shillings.

1. What is the Brokerage on 1750*l.* at 4*s.* per Cent. *Anſ.* 3*l.* 10*s.*

£. 17	50	4	⅕	17 10	1750
	20				4
s. 10	00			£. 3 10	70|000

Anſ. 70*s.* or 3*l.* 10*s.*

2. What is my Commiſſion on 2550*l.* at Half a Crown per Cent. *Anſ.* 3*l.* 3*s.* 9*d.*

3. What is my Commiſſion upon 1760*l.* at 3*l.* ⅛ per Cent. *Anſ.* 55*l.*

SECT. XIII.

Of COMPOUND INTEREST.

Sch. *WHAT do you mean by* Compound Intereſt?

Maſt. Compound Intereſt is that which ariſes from the Principal and Intereſt, put together, when

the Intereſt becomes due: Thus, if I borrow any Sum of Money, ſuppoſe 100 *l.* at 5 *l.* per Cent. then it is plain in 1 Year, the Principal and Intereſt will be 105 *l.* then the 2d Year it will not be the Intereſt of 100 *l.* but of 105 *l.* which will be 5 *l.* 5 *s.* and the 3d Year, it will be the Intereſt of 110 *l.* 5 *s.* *&c.*

RULE.

Find the Intereſt for 1 Year, and add it to the Principal; then find the Intereſt of both Principal and Intereſt for the 2d Year, and thus proceed for the Years given.— Subtract the Principal itſelf from the laſt Sum, and the Remainder will be the *Compound* Intereſt for the Time.

EXAMPLES.

1. What is the Compound Intereſt of 1000 *l.* for three Years, at 5 *l.* per Cent. or what Sum will it amount to in that Time? *Anſ.* It will amount to 1157 *l.* 12 *s.* 6 *d.* and the Compound Intereſt is 157 *l.* 12 *s.* 6 *d.*

2. What is the Compound Intereſt of 115 *l.* 10 *s.* for 5 Years, 7 Months, 15 Days, at 5 *l.* per Cent. *Anſ.* 36 *l.* 3 *s.* 10 *d.* $\frac{1}{2}$.

3. What is the Compound Intereſt of 370 *l.* for 6 Years, at 4 *l.* per Cent. per Annum?

Anſ. 98 *l.* 3 *s.* 4 *d.* $\frac{1}{4}$.

SECT. XIV.

Of REBATE or DISCOUNT.

Sch. *WHAT is* Rebate *or* Diſcount?

Maſt. It is allowing or abating ſo much Money upon a Debt due ſome Time hence, but diſcharged

charged at preſent, as that Money, if put out to Intereſt would gain in the ſame Time, and at the ſame Rate.

RULE.

1. Make 100 *l.* with the Intereſt after the Rate per Cent. given, your 1ſt Number; the Rate per Cent. your 2d Number; and the greater Sum or Debt your 3d Number; and the Anſwer will be the Rebate required.

EXAMPLES.

A had a Note upon B of 100 *l.* due 12 Months to come, but being in great want of Money, got C to Diſcount the Note at 5 *l.* per Cent. I demand how much preſent Money A ought to receive, or how much Diſcount C ought to have? *Anſ.* The Diſcount is 4 *l.* 15 *s.* 2 *d.* $\frac{3}{4}$ $\frac{45}{105}$, which taken from 100 *l.* leaves the preſent Money 95 *l.* 4 *s.* 9 *d.* $\frac{0}{0}$ $\frac{60}{105}$.

Sch. *I ſhould have thought that the Diſcount was exactly* 5 *l. and the preſent Money* 95 *l.*

Maſt. Know that this is the common and cuſtomary Practice, but it is not right; for the Diſcounter has more Diſcount than he ought to have, and the Perſon who had the Note, has not preſent Money enough.

Sch. *Pray make this appear?*

Maſt. If you conſider the Intereſt of 95 *l.* for one Year or 12 Months, at 5 *l.* per Cent. is out 4 *l.* 15 *s.* which added to the preſent Money 95 *l.* gives in all but 99 *l.* 15 *s.* inſtead of 100 *l.* therefore it is 5 *s.* too little; but if you proceed according to the Rule, you will have a true Anſwer. Thus,

If 105 *l.* gives 100 *l.* what will 100 *l.* give. *Anſ.* 95 *l.* 4 *s.* 9 *d.* 0 qrs. $\frac{60}{105}$ the preſent Money; the Intereſt of which for one Year, at 5 *l.* per Cent. is 4 *l.* 15 *s.* 2 *d.* $\frac{3}{4}$ $\frac{45}{105}$, which added to 95 *l.* 4 *s.* 9 *d.* 0 qrs. $\frac{60}{805}$ gives juſt 100 *l.*

More EXAMPLES.

2. What preſent Money will ſatisfy a Debt of 219*l.* due a Year hence, allowing Rebate at 6*l.* per Cent. *Anſ.* 206*l.* 12*s.* 0*d.* $\frac{3}{4}$. Rebate 12*l.* 7*s.* 11*d.* $\frac{1}{4}$.

3. What preſent Money will diſcharge a Debt of 714*l.* due 2 Years $\frac{1}{4}$, or 3 Months hence, allowing Rebate at 6*l.* per Cent. *Anſ.* 629*l.* 1*s.* 7*d.* $\frac{1}{4}$. Rebate 84*l.* 18*s.* 4*d.* $\frac{3}{4}$.

4. A dying, left B his Son, an Eſtate of 1409*l.* 12*s.* 4*d.* which he was not to have till 4 Years and 5 Months to come; but he wanting Money, offered to ſell it to C, the Tenant, for preſent Money at 6*l.* per Cent. Diſcount; I demand what preſent Money will diſcharge the Debt, and what is the Diſcount upon the Sum that was left to B? *Anſ.* The preſent Money or Caſh paid down is 1114*l.* 5*s.* 10*d.* and the Diſcount is 295*l.* 6*s.* 6*d.*

SECT. XV.

EQUATION of PAYMENT.

Sch. *WHAT do you mean by this Rule?*

Maſt. It teaches us to find a mean Time for paying at once various Sums of Money, due at different Times, ſo that neither the Debtor nor Creditor may be a Sufferer.

Sch. *What is the Rule?*

Maſt. It is this,

Multiply each Payment by the Time in Months or Weeks, in which it is to be paid; then add all theſe Products together, and divide the Sum by the whole Debt, and the Quotient gives the mean or equated Time.

EXAM-

EXAMPLES.

1. A owed B 400*l.* and agreed to pay him 150*l.* in four Months, and the remaining 250*l.* in 6 Months; but they at laſt agreed to reduce the Whole to one Payment; I demand the Time? *Anſ.* 5 $\frac{1}{4}$ Months.

2. B borrowed of A 400*l.* of which 250*l.* was to be paid in 4 Months, and 150*l.* in 6 Months; but they agreed to make the Diſcharge by one Payment; I demand the Time. *Anſ.* 4 $\frac{3}{4}$ Months.

3. A Perſon borrowed of his Friend 840*l.* for three Months; but receiving ſome Money on the ſame Day, remitted to him 120*l.* I demand the equated Time he ought to pay the Remainder in, or how much Time he ought to have allowed him? *Anſ.* The mean or equated Time is 3 $\frac{1}{2}$ Months. So that by paying 120*l.* down, he has 2 Weeks longer allowed him for paying the Reſt.

SECT. XVI.

OF BARTER.

Sch. *WHAT ſignifies the Word* Barter, *and what is the Uſe of this Rule?*

Maſt. Barter ſignifies *Truck*; and it teaches us to barter or exchange one Commodity for another, ſo that neither of the Parties bartering may be a Loſer.

RULE.

Firſt, Find the Value of that Commodity, whoſe Quantity is given; then find what Quantity of the other, at the Rate propoſed, you may have for the ſame Money.

2dly, When one has Goods at a certain Price ready Money, but in bartering values them at ſomething

more, find what the other ought to rate his Goods at, ſo as to be on an equal footing with the former.

EXAMPLES.

A and B, barter; A has 50 Pieces of Iriſh, worth one with another 2*l.* 15*s.* 6*d.* per Piece: B has Tea worth 8*s.* 4*d.* per lb. what Quantity of Tea muſt B let A have to ballance the value of the Iriſh? *Anſ.* 333 lb. or 2 Cwt. 3 qrs. 25 lb.

2. Two Merchants, A and B barter; A has Sugar worth 4*l.* per Cwt. ready Money, but in Barter he will have 4*l.* 5*s.* per Cwt. B has French Wine worth 45*l.* per Pipe; how much muſt he advance his Wine to equal the Advance of A's Sugar in Barter? *Anſ.* He muſt advance his Wine 2*l.* 16*s.* 3*d.* per Pipe, ſo that each Pipe will be worth 47*l.* 16*s.* 3*d.*

SECT. XVII.

LOSS AND GAIN.

Sch. *WHAT does this Rule teach?*

Maſt. The Profits and Loſs of Trade in buying and ſelling different Commodities, and is but the Rule of Three at beſt.

EXAMPLES.

1. A Linnen-Draper bought 40 Pieces of Iriſh, each containing 24 Yards, for which he gave 115 Guineas; and ſold the Whole Retail at 2*s.* 9*d.* per Yard; what did he gain or loſe? *Anſ.* he gained 11*l.* 5*s.*

2. What is gained per Cent. (that is in laying out 100*l.*) if one Shilling brings me in 14*d.* ½. *Anſ.* 20*l.* 16*s.* 8*d.*

3. A Wine-Merchant bought 7 Hhds. of Wine (63 Gallons

Gallons each) which coſt him 147 *l.* he ſold 2 Hhds for 38 *l.* 10 *s.* and one Hhd. for 20 Guineas, but one Hhd. leaked out 35 Gallons, and the Remainder he ſold out for 8 *s.* 6 *d.* per Gallon; what did he gain or loſe? *Anſ.* He gained 4 *l.* 14 *s.* 6 *d.*

See two more Examples of this Sort in the Rule of Three Direct. Queſtions the 25th, and 32d.

SECT. XVIII.

Of FELLOWSHIP, or PARTNERSHIP.

Sch. *WHAT is the Uſe of this Rule?*

Maſt. It teaches us to adjuſt the Profit or Loſſes in Trade between Partners, in Proportion to their Stock put into Trade: as alſo to divide the Effects of a Bankrupt among his Creditors, or the Legacies left by Will, when there is a Deficiency of Aſſets.

Fellowſhip conſiſts of two Parts, with or without Time, called Single or Double Fellowſhip.

I. SINGLE FELLOWSHIP *without Time.*

Sch. *How is this Rule perform'd?*

Maſt. In the following Manner,

As the whole Stock is to the whole Gain or Loſs; ſo is each Man's particular Share in Stock, to his particular Gain or Loſs; which Shares added together, give the Gain or Loſs.

EXAMPLE.

1. Two Perſons A and B trade; A put into Stock 400 *l.* B put in 200 *l.* they gain by Trade 500 *l.* I demand the Share of each? *Anſ.* A 333 *l.* 6 *s.* 8 *d.* and B 166 *l.* 13 *s.* 4 *d.*

OPER-

OPERATION.

A 400 + B 200 = 600*l.* whole Stock, Then,
As 600 : 500 :: 400 : 333*l.* 6*s.* 8*d.* A's Share.
As 600 : 500 :: 200 : 166*l.* 13*s.* 4*d.* B's Share.

More EXAMPLES.

2. Three Merchants A B and C join in Partnerſhip; A put into Stock 750*l.* B put in 460*l.* and C put in 500*l.* they gain by Trade in 1 Year 684*l.* I demand the Share of each? *Anſ.* A 300, B 184, and C 200.

3. A Bankrupt had 3 Creditors A, B, and C; he owes A 140*l.* B 300*l.* C 160*l.* but his Effects amount to no more than 480*l.* that is, there is 120*l.* deficient. I demand what Share each Man muſt bear of the Loſs? *Anſ.* A loſes 28*l.* B 60*l.* and C 32*l.*

4. Four Merchants A, B, C, and D, built a Ship, which coſt them 1694*l.* of which A paid 704*l.* 12*s.* B paid 109*l.* 12*s.* C 607*l.* 17*s.* and D 271*l.* 19*s.* They freight her, and in her Voyage they cleared or gained between them 102*l.* what is the Share of each?

Proceed as before directed, and you will find the Anſwers with the Remainders added, to be as follows.

	£.	s.	d.		Remainders.
A	42	8	6	$\frac{0}{0}$ —	24000
B	6	11	11	$\frac{3}{4}$ —	10840
C	36	12	0	$\frac{0}{0}$ —	5760
D	16	7	5	$\frac{3}{4}$ —	27160
£.	102	0	0	$\frac{0}{0}$	67760
					33880 } = $\frac{1}{2}$

II. FELLOWSHIP *with Time, called* DOUBLE FELLOWSHIP.

Sch. *Wherein does this differ from* Fellowſhip *without Time?*

Maſt. In no Reſpect but in the Limitation of the Time, and what depends on that Circumſtance.

RULE.

RULE.

Multiply every Man's particular Stock by his given Time; then add all the Products together, and make it your firſt Number; make the whole Profit or Loſs your 2d Number; and every Man's Stock by his Time, your 3d Number: then proceed as in the Rule of Three.

EXAMPLES.

1. Two Merchants enter into Partnerſhip: A put into Stock 2000*l.* for 4 Months; and B put in 1000*l.* for 2 Months, they gain by Trade 250*l.* what's the Share of each? *Anſ.* A gained 200*l.* and B 50*l.*

2. Three Merchants A, B, and C, trade as follows; A put into Stock 500*l.* for 12 Months; B put in 800*l.* for 5 Months; and C put in 200*l.* for 10 Months: They loſe by Trade 1000*l.* I demand what each Man muſt bear of the Loſs? *Anſ.* A muſt bear 500*l.* B 333*l.* 6*s.* 8*d.* and C 166*l.* 13*s.* 4*d.*

3. Three Perſons A, B, and C, enter into Partnerſhip for 12 Months; A put into Stock 100*l.* for 8 Months, and then put in 200*l.* more for the reſt of the Time; B put in 150*l.* for 6 Months, and after that put in 200 more; C put in 500*l.* for 4 Months, and then took out of the Stock 250*l.* at the Year's End they ſettle Affairs, and find they had gained by Trade 1000*l.* what is the Share of each?

	£.	*s.*	*d.*	
A's Share is	222	4	5	$\frac{13000}{49000} = \frac{3}{9}$
B's	333	6	8	
C's	444	8	10	$\frac{16000}{29000} = \frac{6}{9}$
Proof	1000	0	0	$\frac{0}{9}$ $\frac{0}{9}$

SECT.

SECT. XIX.

ALLIGATION MEDIAL.

Sch. *WHAT is* Alligation Medial?

Maſt. It ſhews us how to mix various Commodities together of different Prices; and to find the mean Price they ought to be ſold at when ſo mixed.

RULE.

As the whole Compoſition mixed, is to its Total Value, ſo is any Part of the Compoſition, to the mean Price required.

EXAMPLES.

1. A Maltſter mixes 40 Buſhels of Malt, worth 5*s.* per Buſhel, with 72 Buſhels at 3*s.* per Buſhel, and 80 Buſhels at 2*s.* per Buſhel; I demand what a Buſhel of this Mixture is worth? *Anſ.* 3*s.*

For	40	× 5	= 200		
	72	× 3	216	Buſh.	Shill. Buſ. Sh.
	80	× 2	160	Then, as 192	: 576 :: 1 : 3.
	192		576		

2. A Mealman mixes 30 Buſhels of Flour, at 5*s.* per Buſhel, with 10 Buſhels at 6*s.* a Buſhel, and with 40 Buſhels at 4*s.* per Buſhel; what is a Sack (*viz.* 5 Buſhels) of this Mixture worth? *Anſ.* 1*l.* 3*s.* 1*d.* $\frac{1}{2}$.

3. A Vintner mixes 214 Gallons of Canary, at 7*s.* 6*d.* per Gallon, with 416 Gallons at 5*s.* 4*d.* with 312 Gallons at 9*s.* 5*d.* with 145 Gallons at 8*s.* 7*d.* and

254 Gallons at 9*s*. 2 *d*. I demand what this Mixture is worth per Gallon? *Anſ*. 7*s*. 8*d*. $\frac{1}{4}$ $\frac{1231}{1341}$.

4. A Grocer mixes 12 lb. of Tea at 5*s*. 6*d*. per lb. with 10 lb. of 9*s*. per lb. with 8 lb. at 6*s*. 6*d*. per lb. and 10 lb. at 14*s*. I demand what a lb. of this Mixture is worth. *Anſ*. 8*s*. 8*d*. $\frac{1}{4}$ $\frac{24}{40}$.

II. ALLIGATION ALTERNATE.

Sch. *What is* Alligation Alternate?

Maſt. It is juſt the contrary of Alligation Medial; for as there the Quantities are given to find the mean Price; here you diſcover the Quantities that are to be mixed, by having the mean Price, and the Prices of the different Ingredients: This is found out by the following

RULE.

Having placed the different Prices one under another (in Shillings or Pence) place the mean Price, or the Price that the Mixture is to be ſold at by the Side of them; then link or join together any two of thoſe different Prices, ſo that one of them may be greater, and the other leſs than the mean Price; this being done, take the Difference between any of the Numbers linked, and the mean Price, and place it againſt the other Number that it is linked or coupled with; do the ſame with every one of the Prices or Numbers, and they will be the Quantities required.

EXAMPLE.

1. A Mealman takes 20 Buſhels of two Sorts of Flour, viz. ſome of 5*s*. per Buſhel, and ſome of 3*s*. 4*d*. per Buſhel, and mixes them together in ſuch a Manner that the Whole, when mixt, may be worth 4*s*. per Buſhel; how much muſt he take of each Sort?

Mean

		Price.	
	d.	60*d.*	8
Mean Price	48	40*d.*	12
			20

Anſ. He muſt take 8 Buſhels of that of 5*s.* and 12 Buſhels of that of 3*s.* 4*d.* and the Mixture will be worth 48*d.* or 4*s.* per Buſhel.

OPERATION.

I take 48, the mean Price from 60, the beſt Price, there remains 12, which I place againſt 40, the loweſt Price; then I take 40, the loweſt Price, from the mean 48, and place 8, the Difference, againſt 60, the beſt Price; and the Work is done.

PROOF.

20 Buſhels, viz. 12 Buſhels at 40*d.* or 3*s.* 4*d.* per Buſhel = 40*s.* and 8 Buſhels at 5*s.* per Buſhel = 40*s.* both = 80*s.* = 4*l.* Now 20 Buſhels at 48*d.* or 4*s.* per Buſhel, is = 4*l.* alſo; conſequently the Anſwer is right.

Note. Whenever you have gained a true Anſwer, by finding how much of any Sort, mixt with more of an inferior, or a better Sort, ſhall be worth ſuch a fixed Price; you may from thence find an infinite Number of Anſwers, only by finding Numbers in Proportion to each other, according to the Directions given in the Rule. Thus, in the above Example, the Anſwer was 8 and 12, but ſuppoſe the Quantity not limited.

Then	2	4	6	8	10	12	14	16, &c. Bſhs. of the beſt.
Mixed with	3	6	9	12	15	18	21	24, &c. Bſhs. of the worſt.

EXAMPLES *not regarding Quantity.*

2. A Vintner mixes 4 Sorts of Wine, ſome of 6*s.* ſome of 6*s.* 8*d.* ſome of 8*s.* and ſome of 9*s.* 4*d.* per Gallon

lon; what Quantity muſt he take of each, to make a Mixture that will be worth 7 *s.* 4 *d.* per Gallon.

d.							
88	72	24 = 3 *	Or 88	72	8 = 1
	80	8 = 1		96	16 = 2
	96	8 = 1		80	24 = 3
	112	16 = 2		112	8 = 1

* Here, in Operation the firſt, the Anſwer is 24 Gallons at 6*s.* mixed with 8 Gallons at 6*s.* 8*d.* with 8 at 8*s.* and with 16 at 9*s.* 4*d.* will be worth 7*s.* 4*d.* per Gallon. Or by abbreviating the Numbers, you have 3, 1, 1 and 2 Gallons.

PROOF.

3 Gallons, at 6*s.* per Gallon - -	0	18	0
1 Gallon, at 6*s.* 8*d.* - - -	0	6	8
1 Gallon, at 8*s.* - - - -	0	8	0
2 Gallons, at 9*s.* 4*d.* - - -	0	18	8
7 Gallons coſt - - -	2	11	4
7 Gallons, at 7*s.* 4*d.* mixed, is - -	2	11	4

Or by the ſecond Operation.

There is 8 Gallons at 6*s.* mixed with 16 at 8*s.* with 24 at 6*s.* 8*d.* and 8 at 9*s.* 4*d.* which abbreviated will be as follows:

1 Gallon, at 6*s.* per Gallon - -	0	6	0
2 Gallons, at 8*s.* - - - -	0	16	0
3 Gallons, at 6*s.* 8*d.* - - -	1	0	0
1 Gallon, at 9*s.* 4*d.* - - -	0	9	4
As before	2	11	4

3. A Grocer would mix Sugars of different Prices together, viz. ſome of 6*d.* per lb. ſome of 7*d.* and ſome of 4*d.* per lb. ſo that the Mixture may be worth 5*d.*

per lb. what Quantity of each muſt he take? *Anſ.* 1lb. at 6*d.* 1lb. at 7*d.* and 3lb. at 4*d.*

III. ALLIGATION PARTIAL.

Sch. *I am highly obliged to you, Sir, and I plainly ſee the Nature of the two former Rules; and what is it that* Alligation Partial *teaches?*

Maſt. Having the different *Prices* of all the Simples, and the *Quantity* of any one of them, and the Mean Rate given, to find the other Quantities.

RULE.

1. Subtract the mean Rate from each Price, or the Price from the mean Rate, and place the Difference as before. Then,

2. As the Difference of the *Simple*, whoſe *Quantity* was given, to the reſt of the Differences ſeverally; ſo is the given *Quantity*, to the ſeveral *Quantities* required.

EXAMPLES.

1. A Vintner would mix 8 Gallons of Wine, at 9*s.* 4*d.* per Gallon, with ſome at 6*s.* per Gallon, with ſome of 6*s.* 8*d.* per Gallon, with ſome at 8*s.* per Gallon, ſo that when mixed, it may be worth 7*s.* 4*d.* per Gallon: how much muſt he take of each Sort? *Anſ.* 8 Gallons at 6*s.* 24 Gallons at 6*s.* 8*d.* 16 Gallons at 8*s.* and 8 Gallons at 9*s.* 4*d.*

2. A Brandy Merchant mixes 32 Gallons of French Brandy, worth 7*s.* per Gallon, with ſome of 12*s.* per Gallon, and with Engliſh Spirits at 4*s.* per Gallon, which when mixed may be worth 8*s.* per Gallon; what Quantity muſt he take of each? *Anſ.* 32 Gallons at 7*s.* 32 Gallons at 4*s.* and 40 Gallons at 12*s.* which you may prove at Leiſure.

IV. ALLIGATION TOTAL.

Sch. *What do you mean by* Alligation Total?

Maſt. It is when the Quantity to be mixed, the Price of each Simple, and the Mean Rate are given, to find how much of each Sort will make up the Quantity required.

RULE.

1. Take the *Difference* between the *Mean Rate* and the *Prices* as before; then,

2. As the Sum Total of the *Differences*, is to each particular *Difference*; ſo is the Quantity given, to the *Quantities* required.

EXAMPLE.

A Vintner has 4 Sorts of Wine, ſome of 6*s.* ſome of 6*s.* 8*d.* ſome of 8*s.* and ſome of 9*s.* 4*d.* of which he would make a Mixture of 56 Gallons, worth 7*s.* 4*d.* per Gallon; how many Gallons of each Sort muſt he take? *Anſ.* 24 Gallons of 6*s.* 8 Gallons of 6*s.* 8*d.* 8 Gallons of 8*s.* and 16 Gallons of 9*s.* 4*d.* per Gallon. For 24+8+8+16=56. See this Example in Alligation Alternate.

V. *Of the* USE *of* ALLIGATION *in mixing Metals according to their different Degrees of Fineneſs; or in mixing Medicines together, according to the different Degrees of their being Hot, Cold, or Temperate.*

EXAMPLES.

1. A Goldſmith has 4 Sorts of Gold, *viz.* ſome of 15, ſome of 20, ſome of 22, and ſome of 24 Carrats fine, from which he is to make a Gold Cup to weigh 1lb. 9 oz. ſo that the Mixture may be 17 Carrats fine; how much muſt he take of each? *Anſ.* 15 oz. of 15 Carrats, 2 of 20, 2 of 22, and 2 of 24 Carrats fine.

2. A Refiner has 3 Sorts of Gold, *viz.* ſome of 20, 21, and 22 Carrats fine; and he is to make a Mixture of 1lb. 9oz. I demand how much of each Sort he muſt take, and what Quantity of Alloy he muſt mix with them

them to make the whole Mass 18 Carrats fine. *Ans.* He must take 3 Ounces of Alloy, and 6 Ounces of each Sort of Gold.

COMPOSITION of MEDICINES.

Sch. *Is not this Rule of Use to Chymists, Apothecaries, &c.*

Mast. It is very useful; for notwithstanding every Person in his Profession, is supposed by Custom and Practice to know how to mix his Ingredients, yet in some Cases he would know it still better, and mix the Simples nearer the Truth, by understanding the following Rules or Directions.

First, Every Body, be it a Liquid or Solid, has in it some Degree of Heat or Cold, Dryness or Moisture, and some Bodies between Heat and Cold, are said to be temperate.

Secondly, There are 4 Degrees of Heat, and 4 Degrees of Cold, both deviating from the Degree of being temperate, or neither Hot nor Cold in any Degree.

Thirdly, These different Qualities in Bodies, will be better expressed and understood by the following

TABLE.

Indices	1	2	3	4	5	6	7	8	9	Indices
Degrees	4	3	2	1	0	1	2	3	4	Degrees
	Cold and Moist.			Qualities.	Temperate.	Hot and Dry.			Qualities.	

Fourthly, Here you see Temperate stands in the Center of Cold and Heat, and therefore may represent a Mean.

EXAM-

EXAMPLE.

A Perſon has 4 Sorts of Herbs, *viz.* A, B, C, D, whoſe Qualities are as follows; A is hot in the 4th Degree; B hot in the 2d Degree; C is temperate, and D is cold in the 3d Degree: Of theſe he has made ſeparate Ointments, but now wants to make or mix 1 lb. together, ſo that the Mixture may have the Quality of the firſt Degree of Heat; I demand how much of each Ointment he muſt take.

Anſ. 1 $\frac{1}{3}$ oz. of A of the 4th Degree of Heat.
5 $\frac{1}{3}$ oz. of B in the 2d Degree of Heat.
4 oz. of C that is temperate.
1 $\frac{1}{3}$ oz. of D in the 2d Degree of Cold.

RULE.

Take from the foregoing Table the different Indices that anſwer to, or ſtand oppoſite to its reſpective Degree of Heat and Cold, and link them together as before; and the Index to the Degree the Mixture is to be made in, put in the Margin for a Mean, as you did in the Prices of Merchandiſe, and then proceed as before.

OPERATION.

Deg.	Oz.		Simples.
9	1	A	9 × 1 = 9
6 { 7	4	B	7 × 4 = 28
5	3	C	5 × 3 = 15
2	1	D	2 × 1 = 2
			9 | 54(6

PROOF, &c.

As 9 : 1 :: 12 : 1 $\frac{1}{3}$ A
9 : 4 :: 12 : 5 $\frac{1}{3}$ B
9 : 3 :: 12 : 4 C
9 : 1 :: 12 : 1 $\frac{1}{3}$ D

Anſ. 12 Oz.

OR,

6	9	4	A	9 × 4 = 36
	7	1	B	7 × 1 = 7
	5	1	C	5 × 1 = 5
	2	3	D	3 × 2 = 6

9)54(6

PROOE, &c.

As 9 : 4 :: 12 : 5 $\frac{1}{3}$
9 : 1 :: 12 : 1 $\frac{1}{3}$
9 : 1 :: 12 : 1 $\frac{1}{3}$
9 : 3 :: 12 : 4

Anſ. 12 Oz.

SECT. XX.

The RULE of FALSE, called FALSE POSITION.

Sch. *WHAT do you mean by the Rule of* Falſe?

Maſt. It is that Rule which, by *falſe* or ſuppoſed Numbers, diſcovers the *real* Number required. POSITION is either *ſingle* or *double*.

I. SIN-

I. SINGLE POSITION.

Sch. What is *Single Poſition*?

Maſt. Single Poſition makes Uſe of one *ſuppoſed* Number, and, by means of that, finds out the *true* Number required.

RULE.

As the Sum of all the falſe Numbers, is to the Total given; ſo is any ſuppoſed Number to the true Number required.

EXAMPLE.

Three School Boys, A B and C, diſcourſed about their Ages: ſays B to A, I am $\frac{1}{3}$ of your age older than you; ſays C to B, I am $\frac{1}{4}$ of your Age older than you; and ſays A, I know all our Ages together make 36; I demand the Age of each? *Anſ.* A 9, B 12, and C 15.

OPERATION.

Take any Number of which you can take $\frac{1}{3}$, and ſo contrived, that of the ſecond you can take $\frac{1}{4}$: ſuppoſe for Inſtance, A was 6 Years old, then B $\frac{1}{3}$ more, will be 8, and C $\frac{1}{4}$ more than this, will be 10. Add theſe together, *viz.* $6 + 8 + 10 = 24$, but it ſhould be 36, therefore ſay,

1. As 24 : 36 :: 6 : 9 A's true Age
2. 24 : 36 :: 8 : 12 B's Age
3. 24 : 36 :: 10 : 15 C's Age

36 Proof.

2. A Perſon overtook a Drover with a Flock of Sheep, and ſaid, Well overtaken, Drover, with your 100 Sheep; You are miſtaken in the Number, Sir, ſays the Drover; but if I had as many more, and $\frac{1}{2}$ as many more,

more, and 2½ beſides, I then ſhould have 100; How many Sheep were there? *Anſ.* 39.

3. A School Boy having a Number of Marbles in his Hat, deſired another Boy to gueſs at them, who ſaid there were 6 Score and 5; No, ſays the other, if there were ⅔ds ¼th and ⅙ more, I ſhould then have that Number; I demand how many there were? *Anſ.* 60.

II. DOUBLE POSITION.

Sch. *How is this performed?*

Maſt. By making Uſe of 2 falſe Numbers, and by working with the Errors that ariſe, you will thereby diſcover the true Anſwer, if you obſerve the following

RULE.

Firſt, Suppoſe any Number at Pleaſure, that will anſwer the Condition of the Queſtion propoſed, and work with it in the ſame manner as if it were the real Number; and if it comes out too *much* or too *little*, viz. *more* or *leſs* than the given Number, note down the difference, and call this the 1ſt *Error*; then propoſe another Number, and work with it in the ſame way.

Secondly, Set the 1ſt *Error* right againſt the 1ſt *Poſition* or Number you worked by, and the 2d *Error* againſt the 2d *Poſition*, and multiply them croſs-ways, *viz.* the 1ſt *Poſition* by the 2d *Error*, and the 2d *Poſition* by the 1ſt *Error*. Then,

Thirdly, If the *Errors* be both too *much* or both too *little*, make the Difference of the Products (before mentioned) your *Dividend*, and the Difference of the *Errors* your *Diviſor*; but if *one* be too *much*, and the *other* too *little*, make the Sum of the ſaid Products a *Dividend*, and the Sum of the *Errors* a *Diviſor*, and the *Quotient* gives the true Anſwer.

EXAMPLES.

1. What Number is that which being multiplied by 12, and having 18 added to the Product, the Sum will be 294? *Anſ.* 23.

OPER-

OPERATION.

Suppoſe	17	Suppoſe	20
Multiply by	12	Multiply by	12
	204		240
Add	18	Add	18
Take this	222 too little [by 72.	Take this	258 too little by 36.
From	294	From	294
	72		36

Sup. Errors.
17 X 72
20 X 36

1440 612
612

72 Diviſor.
36
36 Diviſor.

36)828(23 real Number.
72
108
108

2. What Number is that to which if I add 24, then from that Sum ſubtract 8, and multiply the Remainder by 5, the Product will be 320? *Anſ.* 48.

3. Three School Boys, *Tommy*, *Billy*, and *Charley*, had 200 Marbles divided among them; *Billy* had 6 more than *Tommy*, and *Charley* had 8 more than *Billy*; How many had each? *Anſ. Tommy* 60, *Billy* 66, and *Charley* 74.

4. *Alexander* ſaid to *Epheſtion*, I am older than you by 2 Years; *Clitus* being preſent, ſaid, I am older by 4 Years than both of you; and my Father who is now 96, is as old as all of us; I demand the ſeparate Ages of

of *Alexander*, *Epheſtion*, and *Clitus*. *Anſ.* *Alexander* 24, *Epheſtion* 22, and *Clitus* 50.

5. Three Perſons A, B, and C, trade and gain 3000*l.* The Share of A was $\frac{1}{2}$ the Share of B, and the Share of B $\frac{1}{3}$ the Share of C; I demand the Share of each? *Anſ.* A 333*l.* 6*s.* 8*d.* B 666*l.* 13*s.* 4*d.* and C 2000*l.*

6. A Perſon had a Number of Guineas in a Bag, and deſired a Stander-by to gueſs at them, who anſwers 600: No, ſays he, if to what I have were added $\frac{1}{2}$, $\frac{1}{3}$, and $\frac{1}{4}$, and from that Sum were ſubtracted $\frac{1}{12}$ of what I now have, the Remainder would then be 600; I demand what Number he had? *Anſ.* 300*l.*

SECT. XXI.

Of EXCHANGE.

Sch. *WHAT is* Exchange?

Maſt. It is like Barter in Effect: for it is only Money, Weight, or Meaſure, received in one Nation or Country, for the ſame Value paid in another Nation or Country.

Sch. *I underſtand this; but I have read of, and often heard Perſons talking about the Par and Courſe of Exchange; pray what are theſe?*

Maſt. The Par of Exchange is always the ſame; for it is only the real and true intrinſick Value of any foreign Coin, compared with ſterling Money.

Sch. *What is the Courſe of Exchange?*

Maſt. This is at no Certainty, but differs almoſt every Day, according as Money or Caſh may be more or leſs plentiful or ſcarce, and therefore this Courſe or Alteration is ſaid among Merchants, to be above or below Par, viz. more or leſs than the real Value: Do you underſtand me?

Sch. *I do very well.*

Maſt.

Maſt. Then you are to obſerve the Exchange between *London* and other Places.

I. FRANCE.

The French keep their Accompts at *Paris*, *Lyons*, *Rouen*, *&c.* in Livres, Sols, and Deniers, the Exchange by the Crown being = 4*s.* 6*d.* at Par.

TABLE.

12 Deniers		1 Sol.
20 Sols	make	1 Livre.
3 Livres		1 Crown.

Note. The Livre is imaginary.

EXAMPLES.

1. What muſt be paid in *London* to receive at *Paris* 1516 Crowns, Exchange at 4*s.* 8*d.* per Crown?
Anſ. 353*l.* 14*s.* 8*d.*
2. A Merchant in *London* remits to his Correſpondent at *Paris*, 353*l.* 14*s.* 8*d.* how many French Crowns at 4*s.* 8*d.* each, muſt he receive for it? *Anſ.* 1516 Crowns.

II. HOLLAND, FLANDERS, and GERMANY.

The Accompts are kept chiefly at *Amſterdam*, *Rotterdam*, *Antwerp*, *Bruſſels*, *Hamburgh*, &c. Some in Guilders, Stivers, and Pennings; others in Pounds, Shillings, and Pence. The Exchange with us is one of our Pounds with the Pound Flemiſh, at 33*s.* 4*d.* Par.

TABLE.

TABLE.

8 Pennings	Make	1 Grote.
2 Grotes		1 Stiver.
6 Stivers		1 Schelling.
20 Stivers		1 Guilder or Florin.
20 Schellings		1 Pound.

RULE *to change Sterling into Flemiſh.*

As 1 Pound Sterling is to the Rate given, ſo is the Sterling given, to the Flemiſh ſought.

To change Flemiſh into Sterling.

As the given Rate is to 1 Pound Sterling, ſo is the Flemiſh Sum given, to the Sterling required.

EXAMPLE.

1. A in *London* acquaints his Correſpondent B in *Amſterdam* that he diſburſed 500*l.* Sterling on his Account; what muſt B pay in *Amſterdam*, when the Courſe of Exchange is 33*s.* 4*d.* Flemiſh for one Pound Sterling. *Anſ.* 833*l.* 6*s.* 8*d.*

2. A Merchant at *Hamburgh* remits 2527*l.* 11*s.* 6*d.* Flemiſh, to his Correſpondent in *London*; what Sterling Money ought he to draw for, when the Exchange is 33*s.* 6*d.* Flemiſh, per Pound Sterling. *Anſ.* 1509*l.*

III. SPAIN.

Accompts are kept at *Madrid*, *Cadiz*, *Seville*, &c. in Dollars, Rials, Marvedies or Maravedies, and the Exchange is by the Piece of Eight = 4*s.* 6*d.* Par.

TABLE.

TABLE.

54 Marvedies	Make	1 Rial.
8 Rials		1 Piaſtre or Piece of Eight.
10 Rials		1 Dollar.

EXAMPLES.

1. A Merchant at *London* remits to his Correſpondent at *Cadiz*, 1188*l.* 12*s.* to receive the ſame in Dollars, at 56*d.* each. How many ought he to receive?
Anſ. 5094.

2. A Merchant at *Cadiz* remits to his Correſpondent in *London* 5094 Dollars, at 56*d.* each, to receive the ſame in Sterling Money. What muſt he receive?
Anſ. 1188*l.* 12*s.*

IV. PORTUGAL.

Sch. *How do the* Portugueſe *keep their Accompts?*

Maſt. They keep their Accompts at *Liſbon* and *Oporto*, in Reas, and Exchange on the Milrea, which is equal to 6*s.* 8*d.* ½ at Par.

N. B. One Thouſand Reas make a Milrea.

EXAMPLES.

1. A Merchant at *London* draws a Bill upon his Correſpondent at *Liſbon*, for 666*l.* 13*s.* 4*d.* to receive the ſame in Milreas, at 6*s.* 8*d.* each. How many muſt he receive? *Anſ.* 2000.

2. A Perſon in *Oporto* remits to his Correſpondent at *London* 1375 Milreas at 6*s.* 5*d.* each, to receive the ſame in Sterling Money; what muſt he receive?
Anſ. 441*l.* 2*s.* 11*d.*

V. ITALY.

Sch. *In what Manner are Accompts kept in* Italy?

Maſt. At *Leghorn* and *Genoa*, in Livres, Sols, and Deniers, and Exchange is by the Piece of Eight or Dollar, ar 4*s.* 6*d.* at Par.

TABLE.

12 Deniers	Make	1 Sol.
20 Sols		1 Livre
5 Livres		1 Genoa Piece of Eight.
6 Livres		1 Leghorn Piece of Eight.

At *Venice* and *Florence*, Exchange is by Ducats and Ducatoons.

Thus, 6 Solidi	Make	1 Grofs.
2 Groſſes		1 Ducat.

EXAMPLES.

1. A Gentleman on his Travels through *Leghorn*, would exchange 107 *l.* 15 *s.* 4 *d.* for Dollars, at 53 *d.* each; how many ought he to receive? *Anſ.* 488.

2. A Merchant at *Venice* ſent to *London* 825 Pieces of Eight at 53 *d.* each, to receive the ſame in Sterling Money; I demand what he ought to receive?

Anſ. 182 *l.* 3 *s.* 9 *d.*

N. B. There is a Difference between Bank Money and current Money in ſome of theſe Places; which Difference is called *Agio*, viz. the Advance of the Bank above the current Money, and this is from 3 to 6 per Cent. in Guilders; therefore by the Rule of Three,

To turn Bank into Current Money.

1. As 100 Guilders Bank, is to 100 with the Agio added; ſo is the Price of the Bank, to the current Money required.

To turn Currency into Bank.

2. As 100 with the Agio added is to 100 Bank, ſo is the Current Money given, to the Price the Bank bears.

EXAM-

EXAMPLE.

A Gentleman at *Hamburgh* was obliged to change 1589 Florins or Guilders, and 10 Stivers current Money, into Bank Florins, Agio 4 $\frac{3}{8}$: How many did he receive?

Sch. *He received* 1522 *Florins*, 17 *Stivers*, 7 *Pennings*.

VI. IRELAND.

1. A Gentleman remits to *Ireland*, 420 *l.* What Sum muſt he receive there, the Exchange being at 10 per Cent? *Anſ.* 462 *l.*

2. A Merchant at *Dublin* remits to *England* 462 *l.* Iriſh. What muſt he receive at *London* for that Sum, the Exchange being at 10 per Cent? *Anſ.* 420 *l.*

Of WEIGHTS and MEASURES.

I. *Of Simple Compariſon.*

RULE.

This is done by the Rule of Three, by minding the Condition of the Queſtion, and the Anſwer required.

EXAMPLES.

1. Suppoſe 100 Ells of *Antwerp* make 75 Yards of *London* Meaſure; how many Yards of *London* will be equal to 54 Ells of *Antwerp*? *Anſ.* 40$\frac{1}{2}$ Yards.

2. If 60 lb. at *London* make 56 lb. at *Leghorn*; how many lbs. at *London* will be equal to 700 lb. at *Leghorn*? *Anſ.* 750 lb.

II. *Of Compound Compariſon.*

This is when the Coin, Weights or Meaſures of various Countries are linked together, and compared with

each other, and it is required how much of the firſt Sort will be equal to the Quantity given of the laſt Sort.

Rule 1.

Range or place the Numbers in two Rows, *viz.* ſet the 1ſt on the left; the next by the Side of it on the right; then the 3d under the 1ſt in the left Hand Row; and the 4th under the right Hand Row; and thus go on, but obſerve that the laſt Number be placed in the left Row.—Then

Rule 2.

Multiply all the Numbers on the left Hand together for a Dividend, and thoſe on the right Hand for a Diviſor, and the Quotient will give the Anſwer.

Examples.

If 6 lb. at *London*, make 5 lb. at *Venice*; and 50 lb. at *Venice* make 60 lb. at *Naples*; how many lb. at *London* will be equal to 20 lb. at *Naples*? *Anſ.* 20.

Note, When it is required to know how many of the laſt Sort is equal to a Quantity of the firſt, then place the Numbers as before, only let the laſt Number fall on the right Hand; and multiply the firſt Row for a Diviſor, and the Second for a Dividend.

If 6 lb. at *London* make 5 lb. at *Venice*, and 50 lb. at *Venice* make 60 lb. at *Naples*; how many lb. at *Naples* will be equal to 20 lb. at *London*? *Anſ.* 20.

SECT.

SECT. XXII.

Of PROGRESSION.

WHAT do you mean by Progreſſion?

Maſt. The regular Progreſſion, Moving, or Flowing of a Number in progreſſive, regular and uniform Order, according to a certain given Rate or Ratio.

Sch. *Does Progreſſion conſiſt of more Parts than one?*

Maſt. Yes, it conſiſts of 2 Parts, called Arithmetical, and Geometrical.

Sch. *What is the Difference between them?*

Maſt. Arithmetical Progreſſion is the Effect of a continual Addition or Subtraction, and Geometrical Progreſſion is the Effect of a continual Multiplication or Diviſion.

I. Of ARITHMETICAL PROGRESSION.

Sch. *Pleaſe to define this Kind of Progreſſion a little more particularly.*

Maſt. I will. — Arithmetical Progreſſion is the Moving, Flowing, or Progreſſion of Numbers in a regular and uniform Manner, as 1. 2. 3. 4. &c. proceed, or move progreſſively by 1, every following Number exceeding the foregoing by the Difference of 1, or is 1 more, and this Difference is called the Ratio. So alſo 1. 5. 9. 13. 17, &c. differ by 4 in Arithmetical Progreſſion, which 4 is called the Ratio: Again, 8. 17. 26. 35. 44. 53, &c. differ by the Ratio of 9. From hence ariſe the following Obſervations, which pray mind.

OBSERVATION 1.

In any Series of Numbers in Arithmetical Progreſſion, if the Series be odd, as 1. 5. 9. 13. 17. the

Double of the Mean will be equal to the 2 Extremes, as 1 + 17 = 18, &c. But if the Number of Places be even, then any 2 Middle Numbers equi-distant from the Extremes, will be equal to the Extremes; thus in the above-mentioned Numbers, 8. 17. 26. 35. 44. and 53; the 2 Middle Terms or Numbers 26 and 35, are equal to the Extremes 8 and 53; for 8 + 53 = 26 + 35 = 61.

OBSERVATION. 2.

There are 5 Things to be obſerved in this Rule, *viz.* 1. The firſt Term or Number. Secondly, The laſt Term. Thirdly, The Number of Terms. Fourthly, The Ratio or Difference between the Terms; and, Fifthly, The Sum of all the Terms or the whole Series.

Any three of theſe Terms being given, the other two may be found.

CASE. I.

The 1ſt, 2d, and 3d Term given, that is, the firſt and laſt Number, and Number of Terms, to find the Sum or Amount of the whole Series.

RULE.

Multiply $\frac{1}{2}$ the Sum of the Extremes by the Number of Places, the Product is the Total: Or multiply the Sum of the 2 Extremes by $\frac{1}{2}$ the Number of Places, you will likewiſe have the Total.

EXAMPLES.

1. How many Times does the Clock ſtrike in twelve Hours? *Anſ.* 78.

1 + 12 = 13 Extr. then 13 × 6 ($\frac{1}{2}$ the Number of Places) = 78 Strokes.

2 Sup-

2. Suppoſe 100 Stones to be placed a Yard aſunder from each other in a right Line; and a Man engages to pick them up one by one, bringing every ſeparate Stone back to a Baſket where the firſt Stone lay; how far does he go? *Anſ.* 5 ½ Miles and 420 Yards, that is, 5 ¾ Miles wanting 20 Yards.

CASE 2.

The 1ſt, 2d, and 3d Term given, to find the Ratio.

RULE.

From the laſt take the 1ſt Number, and make the Difference a Dividend; then take the Number of Terms, leſs 1, and make it a Diviſor; and the Quotient will give the Ratio or common Exceſs.

EXAMPLES.

1. A Perſon had 9 Children; the youngeſt was 2 Years old, and the eldeſt 26; and all differed alike in Arithmetical Progreſſion: I demand the Ratio or Difference of their Ages? *Anſ.* 3. For $26 - 2 = 24$, the Difference of the Extremes, is the Dividend; and 9, the Number of Places leſs $1 = 8$ is the Diviſor; conſequently, $24 \div 8 = 3$ the Ratio.

2. A Man undertook a Journey from London for a Fortnight; but he was to go 2 Miles only the firſt Day, and every Day after at a certain or equal Exceſs; now the laſt Day he travelled 67 Miles; I demand the Ratio, Exceſs, or daily Increaſe? *Anſ.* 5.

CASE 3.

The Extremes, viz. the firſt and laſt Number and Ratio given, to find the Number of Terms.

RULE.

RULE.

From the laſt Number or Extreme take the 1ſt Number, divide the Remainder by the Ratio, and add the Quotient, and this will give the Number of Places.

EXAMPLE.

A Perſon undertook a Journey; he went 2 Miles the 1ſt Day, and encreaſed 5 Miles every Day, till the laſt Day he travelled 67 Miles; how many Days did he travel? *Anſ.* 14 Days or a Fortnight. See the laſt Caſe.

CASE 4.

The laſt Term, Number of Places, and Ratio given, to find the 1ſt Number.

RULE.

Multiply the Number of Terms, leſs 1, by the Ratio; then ſubtract this Product from the laſt Term, and the Remainder will be the 1ſt Number.

EXAMPLE.

A Perſon travelled daily for a Fortnight from London towards the North, encreaſing every Day's Journey 5 Miles, ſo that the laſt Day he went 67 Miles; I demand what he went the firſt Day? *Anſ.* 2 Miles.

CASE. 5.

The Sum of the Terms, the Number of Terms, and Ratio given, to find the firſt Term.

RULE.

RULE.

Divide the Sum of the Terms, by the Number of Places, and reſerve the Quotient; then multiply the Number of Places, leſs 1, by the Ratio, and take $\frac{1}{2}$ of this Product from the aforeſaid Quotient, and you have the firſt Number.

EXAMPLE.

A was indebted to B the Sum of 720*l.* for which B threatened to Arreſt him; but A promiſed to pay a certain Sum down, and diſcharge the whole by 11 other regular Payments, each to be 8*l.* more than the preceding one; I demand the Money A paid down, viz. the 1ſt Payment of A? *Anſ.* 16*l.*

CASE 6.

The 1ſt Term, Number of Terms, and Ratio given, to find the laſt Number.

RULE.

Multiply the Number of Places leſs 1, by the Ratio, and to that Product add the firſt Number or Term, and this Sum gives the laſt Term.

EXAMPLE.

A owed B 720*l.* and paid him 16*l.* down, and was to make 11 other Payments, whoſe Ratio increaſed by 8*l.* every Payment; I demand the laſt Payment, and how much it exceeded the firſt? *Anſ.* 104*l.* laſt Payment.

II. Of GEOMETRICAL PROGRESSION.

Sch. *What is the Difference between this and Arithmetical Progreſſion?*

Maſt. There is a wide Difference between them; for the firſt was only a continual Progreſſion of Numbers, differing by the Addition of any Number; but Geometrical Progreſſion is the continued Increaſe of Numbers by Multiplication. Thus, 2. 4. 8. 16. 32, &c. increaſe by the Multiplication of 2, every next Number being the Double of its foregoing Number. So alſo 8. 64. 512. and 4096. are every one of them 8 Times more than its preceding Number, and this Difference 8 Times, or any other Difference, is called the Ratio. Do you Underſtand it?

Sch. *Yes, very well.*

Maſt. Then you muſt carefully mind the following Obſervations.

OBSERVATION I.

In any odd Number of Terms in Geometrical Progreſſion, the middle Number, (called always the Mean) multiplied by itſelf, will be equal to the Product of the firſt and laſt Numbers or Extremes.

Let the Numbers be 4. 12. 36. differing by three Times, or in a three-fold Ratio; then I multiply the Mean or middle Number 12 into itſelf, and it is equal to the Extremes $4 \times 36 = 144 = 12 \times 12$.

OBSERVATION. 2.

If the Number of Terms be even, then the Product of the 2 middle Terms, or any 2 Terms equi-diſtant from the Extremes, will be equal to the Product of the Extremes. Let the Numbers be 4. 12. 36. 108. whoſe Ratio is 3; I ſay 12×36 the Means, is $= 4 \times 108$, the Extremes $= 432$. Again let the Numbers be 3. 9. 27. 81. 243. 729. whoſe Ratio is 3; I ſay 27×81 the

the Means = 3 × 729 the Extremes = 2187, and ſo if the Numbers were ever ſo many, and even withal.

OPERATION 3.

If in 4 Numbers the Progreſſion be diſcontinued between the 2d and the 3d, that is, though you ſet down the 3d Number by Gueſs or at Random, yet if you make the 4th differing from it, in the ſame Ratio as the ſecond does from the firſt, you will ſtill find the Rectangle, or Product of the Means, to be equal to the Rectangle of the Extremes.

Let the Numbers be 4, 36, 21, 189, whoſe Ratio is 9; I ſay 36 × 21 = 189 × 4 = 756, notwithſtanding you ſee the 3d Term is leſs than the 2d.— Or let them be 2, 12, 144, and 864; the 12 × 144 = 864 × 2 = 1728.

OBSERVATION 4.

The 3 laſt Obſervations being well conſidered, you will, from them and the following Caſes, ſoon learn to diſcover any one of the following Things relating to this Rule, viz. *The 1ſt Number or Term.* 2. *The laſt Number.* 3. *The Number of Terms or Places.* 4 *The Ratio or Difference of one Term from another*; *and* 5. *The Sum Total of all the Terms.*

OBSERVATION. 5.

The Ratio of any Series is found by dividing any one of the Conſequents by its Antecedent or foregoing Number.

OBSERVATION. 6.

In order to ſhorten the tedious Work of a continued Multiplication of a large Series of Places, the beſt Way is to ſet over the Geometrical Numbers, a Series

ries of Numbers in Arithmetical Progreſſion, which are called Indices, Indexes, or Exponents.

Thus 1 2 3 4 5 Indices in Arith. Progreſſion.
And 2 4 8 16 32 Numbers in Geom. Progreſſion.

But when the Terms in Geometrical Progreſſion begin with One or Unity, then the Indices or Exponents muſt begin with a Cypher; therefore the whole Numbers will have one Place leſs in the Indices than in the Progreſſion, Thus,

0	1	2	3	4	5	6	7	8	9 and
1	2	4	8	16	32	64	128	256	582

OBSERVATION 7.

From hence it appears that the Places, or any ſingle Place remote from the 1ſt Place, may be found by the Indices thus; add any 2 Indices together, and that Sum will agree with the Product of their reſpective Terms in the Geometrical Progreſſion; thus, ſuppoſe I take 2 and 3 in the Indices; the $2 + 3 = 5$ or the 5th Place, and 4×8 (which anſwers to 2 and 3) in the Progreſſion $= 32$, which ſtands under the 5th Index: Again $2 + 7 = 9$, therefore $128 \times 4 = 512$ the 9th Place, or $4 + 5 = 9$, viz. $16 \times 32 = 512$ as before: thus may any remote Number be found.

CASE 1.

The 1ſt Number, Ratio, and Numbers of Places given, to find the laſt Number without producing all the intermediate Terms.

RULE.

Find what Figures of the Indices added together will give the Exponents of the Term wanted: then multiply the Numbers ſtanding under ſuch Exponents

ponents into each other, and the Product will be the Term required. But always remember that when the Exponent 1 ſtands over the ſecond Geometrical Term, the Number of Exponents muſt be 1 leſs than the Number of Terms.

EXAMPLES.

1: I demand the laſt Number of 11 Places in Geometrical Progreſſion, whoſe firſt Number is 1, and the Ratio 9? *Anſ.* 3486784401.

OPERATION.

0, 1, 2, 3, Exponents.
1, 9, 81, 729, Terms.

729 = 3
729 = 3
6561
1458
5103
531441
729 = 3
4782969
1062882
3720087
387420489
9 = 1
3486784401

For 3 + 3 + 3 + 1 = 10 No. of Terms leſs 1.

Or the Queſtion may be ſolved, without the Help of the Indices, by the following,

Rule.

Find any Number of Places at Pleaſure, by multiplying the firſt Number by the Ratio, and that Product by the Ratio, and ſo on: This being done, ſquare the Number you left off at (viz. multiply it by itſelf) and the Product will be double the Number of the Places leſs 1 Place.

Firſt, I multiply 1 by 9, and ſo continue to the 6th Place $1 \times 9 \times 9 \times 9 \times 9 \times 9 = 59049$ the 6th Place; and $59049 \times 59049 = 3486784401$ the 11th Place.

3. A Lady of Quality had a Cook well recommended to her, but they could not agree upon Wages; at laſt the Cook told her Ladyſhip that ſhe was very deſirous of living with her, and would ſerve her for 1 Year (or 12 Months) at the Rate of 1 Shilling per Month, and double it every Month; or otherwiſe for 2 Years, at the Rate of 1 Farthing per Month, 2 Farthings the 2d Month, doubling the Sum every Month, and to be paid only for her laſt Month's Service. The Lady thinking this reaſonable enough, agreed to this laſt Propoſal: What did the Maid's laſt Month's Wages come to?

Anſ. 8738 *l.* 2 *s.* 8 *d.*

Case 2.

The firſt Number, Ratio and Number of Terms given, to find the Sum or Total of all the Series.

Rule.

Find the laſt Term as before; multiply it by the Ratio; from that Product take the firſt Number, and divide the Remainder by the Ratio leſs 1, and the Quotient gives the Sum of all the Series.

Exam-

EXAMPLES.

1. A Grazier offered to ſell 15 fine fat Oxen to a Butcher for 200*l.* but the Butcher would not give it, and ſaid there was one of them that was not worth 6*d.* Upon this the Grazier replied, you ſhall have them all if you will give me only 6 Pence for the 1ſt, a Shilling for the 2d, 2 Shillings for the 3d, &c. The Butcher agreed to it. I demand how much the 15 Oxen ſold for; and what the Butcher gave more for them than what the Grazier aſked him at firſt? *Anſ.* They came to 819*l.* 3*s.* 6*d.* which is 619*l.* 3*s.* 6*d.* more than the Butcher was aſked for them.

2. How much will a Horſe coſt, ſuppoſing he were ſold for only the Price of his 4 Shoes, each having 8 Nails, at a Farthing per Nail, and double the Price of every Nail? *Anſ.*

3. Suppoſe 1 Grain of Wheat to be ſown, and the Produce from it be ſown the 2d Year, and all that Produce ſown the 3d Year, and ſo on for 20 Years, encreaſing no more than 10 Fold (which is 3 Times leſs than it is known to do) I demand how many Grains there will be in all? *Anſ.* 11111111111111111111 Grains. —— Now allowing 7000 Grains to 1 Pint of Wheat, 64 Pints to a Buſhel, and 40 Buſhels to a Load: I demand the Quantity without regarding the Remainders?

Anſ. 1587301587301 58 Pints.
248015873015 8 Buſhels.
62003968253 Loads or Tons.

Now ſuppoſing Wheat at 4*s.* per Buſhel, it would come to the immenſe Sum of 496031746031*l.* 12*s.* and laſtly, ſuppoſing it to be carried away in Ships of 1000 Tons Burthen each, it would take 62003968 ſuch Ships to carry it away, and 253 Tons to ſpare, which is one fourth of another Burthen; ſo amazing is the Increaſe of continued Multiplications!

SECT. XXIII.

Of PERMUTATION.

Sch. *WHAT is meant by* Permutation?

Maſt. The varying or changing the Order of Things: or it ſhews the various Methods of placing Things, or the different Changes of which they are ſuſceptible.

Sch. *How is this Rule perform'd?*

Maſt. Only by a continual Multiplication of the given Number into itſelf as often as is required, and the laſt Product gives the Number of Changes or Variations.

EXAMPLES.

1. How many Changes may be rung on 5 Bells? *Anſ.* 120. For $1 \times 2 \times 3 \times 4 \times 5 = 120$.

2. How many Changes may be rang on 6, 7, and 8 Bells? *Anſ.* 720 on 6; 5040 on 7; and 40320 on 8 Bells.

3. How many different Changes may be rung upon 12 Bells? and ſuppoſe 10 Changes to be rung in a Minute, how long would it take to ring all the Changes completely out, allowing 365 Days, 6 Hours, to a Year. *Anſ.* The Number of Changes is 479001600, and to ring theſe would require 91 Years, 3 Weeks, 5 Days, 6 Hours.

4. An Oxford Scholar came to London, and took Lodgings, for which he only paid after the Rate of 20*l.* a Year; but having a mind to Dine in the Family, which conſiſted but of 5 Perſons beſides himſelf; he aſked the Gentleman how much he ſhould give him to Lodge as uſual, and Dine with him only ſo long as he could place every Perſon in a different Chair, or in a different Poſition at Table. — The Gentleman think-

ing

ing, or rather unthinkingly ſuppoſing, it could not be long, agreed with him for 10 Guineas; I demand how long he ſtaid, and what his Dinners coſt him one Day with another, excluſive of his Lodging?

Anſ. He ſtaid 1 Year and 355 Days, and his Dinner coſt him every Day 3 *d.* $\frac{1}{2}$ only.

SECT. XXIV.

Of VULGAR FRACTIONS.

Sch. *WHAT do you mean by a* Vulgar Fraction?

Maſt. A Fraction is a broken Number, or Part of an Unit or Integer, and conſiſts of two Parts; one called the Numerator, and the other the Denominator. Thus $\frac{3}{4}$, or $\frac{5}{9}$, or $\frac{17}{95}$, are expreſſed 3 Fourths, 5 Ninths, and 17 Ninety fifth Parts of an Unit or Integer.

Sch. *I underſtand this by the Rule of Practice: But pray, which are the Numerators and Denominators of theſe Fractions?*

Maſt. The upper Figures, 3, 5, and 17, are the Numerators, and the lower ones, 4, 9, and 95, are the Denominators.

Sch. *Are Fractions all of one Kind?*

Maſt. No, there are three Sorts, viz. Proper, Improper, and Compound Fractions.

1. A Proper or Simple Fraction is, when the Numerator is leſs than the Denominator. Thus, the foregoing Fraction, $\frac{3}{4}$, $\frac{5}{9}$, $\frac{17}{95}$, &c. are all Simple or Proper Fractions.

2. An Improper Fraction is that which has its Numerator larger than its Denominator, and ſuch are $\frac{4}{3}$, $\frac{9}{5}$, or $\frac{95}{17}$, &c.

Note 1. All Proper Fractions are leſs than, or are only Part of an Integer or Unit; but all Improper Fractions are more in Value than an Unit.

3. A Compound Fraction is a Fraction of a Fraction, and is coupled with another Fraction by the Word *of*. — Thus $\frac{3}{4}$ of $\frac{5}{6}$; or $\frac{3}{5}$ of $\frac{5}{8}$ of $\frac{11}{12}$, are Compound Fractions.

Note 2. All Compound Fractions muſt be reduced to Simple ones, and all Improper Fractions into mixed Numbers.

A mixed Number conſiſts of 2 Parts, viz. a whole Number and a proper Fraction; thus $4\frac{2}{3}$, $15\frac{5}{9}$, and $168\frac{24}{27}$, are all mixed Numbers. Do you underſtand it?

Sch. *I do very well.*

Maſt. Then I will proceed to ſome Rules and Examples.

I. REDUCTION of VULGAR FRACTIONS.

CASE I.

To reduce a mixed Number to an Improper Fraction.

RULE.

Multiply the whole Number by the Denominator of the Fraction, and take in the Numerator; then place this Product over the Denominator for a new Numerator, and the Fraction will be equal to the given mixed Number.

EXAMPLES.

Reduce $4\frac{2}{3}$ to an improper Fraction. *Anſ.* $\frac{14}{3}$.

Reduce $11\frac{7}{9}$ to an improper Fraction. *Anſ.* $\frac{106}{9}$

Reduce

Reduce $14\frac{5}{11}$ to an improper Fraction. *Anſ.* $\frac{159}{11}$.
Reduce $246\frac{11}{12}$ to an improper Fraction. *Anſ.* $\frac{2963}{12}$.

CASE. 2.

To reduce an improper Fraction to a mixed Number, or to its proper Terms.

RULE.

Divide the Numerator by the Denominator, and the Quotient will be the whole Number; and if any Thing remains, place it over the Denominator for a new Numerator.

EXAMPLES.

Reduce $\frac{22}{5}$ to a mixed Number. *Anſ.* $4\frac{2}{5}$.
Reduce $\frac{106}{9}$ to a mixed Number. *Anſ.* $11\frac{7}{9}$.
Reduce $\frac{159}{11}$ to a mixed Number. *Anſ.* $14\frac{5}{11}$.
Reduce $\frac{2963}{12}$ to a mixed Number. *Anſ.* $246\frac{11}{12}$.
Reduce $\frac{45728}{96}$ to a mixed Number. *Anſ.* $476\frac{32}{96}$.

CASE 3.

To reduce a Compound to a Simple Fraction of the ſame Value.

RULE.

Multiply the Numerators together for a new Numerator, and the Denominators together for a new Denominator.

EXAMPLES.

Reduce $\frac{2}{5}$ of $\frac{3}{4}$ to a ſimple or proper Fraction *Anſ.* $\frac{6}{20}$.
Reduce $\frac{1}{5}$ of $\frac{4}{7}$ to a ſimple Fraction. *Anſ.* $\frac{4}{35}$.

Reduce

Reduce $\frac{2}{3}$ of $\frac{1}{2}$ of $\frac{3}{5}$ to a proper Fraction. *Anſ.* $\frac{6}{30}$.
Reduce $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{4}{5}$ to a proper Fraction. *Anſ.* $\frac{24}{120}$.

CASE 4.

To reduce a Fraction to its loweſt Terms.

RULE.

Take Half the Numerator and Denominator as often as you can; or elſe divide them both by any Number that will do ſo without any Remainder; and this laſt Quotient will be the loweſt Term of the Fraction given.

EXAMPLES.

Reduce $\frac{24}{96}$ to its loweſt Terms. *Anſ.* $\frac{1}{4}$.

Here I take the $\frac{1}{2}$ of both as long as I can, and find it is $\frac{1}{4}$: Or I divide both by 12, and then it will be $\frac{2}{8} = \frac{1}{4}$, its loweſt Term.

Reduce $\frac{14}{70}$ to its loweſt Terms. *Anſ.* $\frac{1}{5}$.

Firſt I divide them both by 2, which gives $\frac{7}{35}$; and then this by 7, which gives $\frac{1}{5}$, the Anſwer.

Reduce $\frac{72}{264}$ to its loweſt Terms. *Anſ.* $\frac{3}{11}$.
Reduce $\frac{9450}{15750}$ to its loweſt Terms. *Anſ.* $\frac{3}{5}$.

N. B. There is a Method to find a common Meaſurer, or one Diviſor, which will bring a Fraction to its loweſt Term at one Work or Diviſion; but that will take more Time to find than the Work itſelf may be performed in; therefore I would not chooſe to puzzle the Learner with unneceſſary Niceties.

CASE 5.

To reduce Fractions of different Denominators, to Fractions equal to them, having one common Denominator to all.

RULE.

Rule.

Multiply all the Denominators together for a common Denominator; then begin with the Numerator of the firſt Fraction, and multiply it into every Denominator (except its own Denominator;) do the ſame with all the other Numerators; then place theſe different Products over the common Denominator, and your new Fractions will be equal tothe given Fractions.

Examples.

Reduce $\frac{2}{5}$, $\frac{3}{4}$, and $\frac{5}{8}$, to Fractions having a common Denominator of equal Value.

Here obſerve, that $5 \times 4 \times 8 = 160$, the common Denominator.

Then, $2 \times 4 \times 8 = 64$, for one new Numerator.

Then, $3 \times 5 \times 8 = 120$, a new Numerator, and

Laſtly, $5 \times 4 \times 5 = 100$, a new Numerator: So that the Anſwer is $\frac{64}{160} = \frac{2}{5}$, $\frac{120}{160} = \frac{3}{4}$, and $\frac{100}{160} = \frac{5}{8}$.

Reduce $\frac{4}{5}$, $\frac{3}{12}$, and $\frac{7}{8}$, to Fractions having a common Denominator. *Anſ.* $\frac{384}{480}$, $\frac{120}{480}$, and $\frac{420}{480}$

Case 6.

To reduce Fractions of one Denomination to Fractions of another.

This is either aſcending or deſcending.

I. Aſcending.

Rule.

When a Fraction of a ſmaller, is to be brought into another of a greater Denomination, make of it a compound Fraction, by ſetting the Parts contained in every aſcending Interger underneath for Denominators, and an Unit over them for Numerators; then multiply all the

the Numerators together for a new Numerator, and all the Denominators together for a new Denominator: ſo ſhall this Fraction of the laſt Name be equal to the given Fraction of the firſt Name.

EXAMPLES.

Reduce $\frac{1}{4}$ of a Penny to the Fraction of a Pound Sterling. *Anſ.* $\frac{1}{960}$ of a Pound.

Thus $\frac{1}{4}$ of $\frac{1}{12}$ of $\frac{1}{20} = \frac{1}{960}$, that is, $\frac{1}{4}$ of a Penny is $= \frac{1}{960}$ of a Pound $=$ 1 Farthing.

Reduce $\frac{3}{4}$ of a Farthing to the Fraction of a Guinea. *Anſ.* $\frac{3}{4032}$.

Reduce $\frac{1}{4}$ of a lb. to the Fraction of a Ton. *Anſ.* $\frac{1}{8960}$

II. DESCENDING.

This is quite the Reverſe of the former; for though you muſt make a compound Fraction of the Parts of the Integer as before, yet thoſe Parts muſt now be made Numerators, and an Unit Denominators to them: Then reduce them to a ſimple or proper Fraction, and you have the Anſwer.

EXAMPLES.

Reduce $\frac{1}{960}$ of a Pound Sterling to the Fraction of a Penny. *Anſ.* $\frac{1}{4}$.

For $\frac{20}{1}$ of $\frac{12}{1}$ of $\frac{4}{1} = \frac{960}{1}$.

Reduce $\frac{3}{4032}$ of a Guinea to the Fraction of a Farthing. *Anſ.*

Reduce $\frac{1}{8960}$ of a Ton to the Fraction of a lb. *Anſ.*

CASE. 7.

To find the Value of a Vulgar Fraction in Money, Weight, or Meaſure.

N. B.

N. B. This being the moſt uſeful Caſe for knowing the Value of any Fraction when compared with an Unit, the young Tyro cannot be too much inſtructed in its Uſe and Practice.

RULE.

Multiply the Numerator by the common Parts of the Integer, and divide by the Denominator, and the ſeveral Quotients will be the Anſwer.

Sch. *This Rule is very intricate to me at preſent; I wiſh you would give me one Example at large, as before.*

Maſt. I will.

What is the Value of $\frac{14}{25}$ of a Pound Sterling?

14
20

25)280(11*s.*
25

30
25

5
12

25)60(2*d.*
50

10
4

25)40(1*qr*
25

15

Anſ. 11*s.* 2*d.* $\frac{1}{4}$ $\frac{15}{25}$ or $\frac{3}{5}$ of a Farthing.

Here you ſee the Proceſs is ſo plain, that let it be Money, Weight, or Meaſure, you cannot fail to have an Anſwer, if you duly attend to the Work.

EXAM-

EXAMPLES *for Trial.*

What is the Value of $\frac{41}{287}$ of a Pound?
Anſ. 2*s.* 10*d.* $\frac{1}{4}$ $\frac{41}{287}$ or $\frac{1}{7}$.
What is the Value of $\frac{11}{55}$ of a Moidore?
Anſ. 5*s.* 4*d.* $\frac{3}{4}$ $\frac{11}{55}$ or $\frac{1}{5}$.
What is the Value of $\frac{14}{1120}$ of a Hundred-weight?
Anſ. 12lb. 7oz. 1dr. $\frac{98}{1120}$ or $\frac{7}{80}$.
What is the Value of $\frac{4}{44}$ of a Pound Troy?
Anſ. 1oz. 1dwt. 19gr. $\frac{28}{44}$ or $\frac{7}{11}$.
What is the Value of $\frac{13}{1560}$ of a Hogſhead of Wine?
Anſ. $5\frac{1}{4}$ Gallons.
What is the Value of $\frac{14}{1584}$ of a Mile?
Anſ. 160 Yards.
What is the Value of $\frac{146}{5552}$ of a Year?
Anſ. 96 Days, 12 H. 57 M. 23 Sec. $\frac{240}{5552}$.

II. ADDITION of VULGAR FRACTIONS.

Sch. *How is Addition of Vulgar Fractions performed?*
Maſt. If you are perfect in the foregoing Caſes in Reduction, you will ſoon be able to do all the other Rules.

CASE I.

When the Fractions have one common Denominator, then only add all the Numerators together, and place them over the common Denominator; and if it be an improper Fraction, reduce it to a mixed Number.

Add $\frac{2}{14}$, $\frac{3}{14}$, and $\frac{7}{14}$ together. *Anſ.* $\frac{12}{14} = \frac{6}{7}$.
Add $\frac{4}{7}$, $\frac{1}{7}$, $\frac{6}{7}$, $\frac{5}{7}$, and $\frac{3}{7}$ together. *Anſ.* $\frac{19}{7} = 2\frac{5}{7}$.
Add $\frac{144}{246}$, $\frac{147}{246}$, $\frac{39}{246}$, and $\frac{217}{246}$, together.
Anſ. $\frac{547}{246} = 2\frac{55}{246}$.

CASE.

CASE. 2.

When the Fractions have not a common Denominator, reduce them to one, and then add the Numerators together, as before directed.

Add $\frac{3}{4}$ and $\frac{4}{5}$ together. *Anſ.* $\frac{31}{20} = 1\ \frac{11}{20}$.
For $\frac{3}{4}$ and $\frac{4}{5}$ reduced are $\frac{15}{20}$ and $\frac{16}{20} = \frac{31}{20} = 1\ \frac{11}{20}$.
Add $\frac{3}{4}$, $\frac{4}{5}$, and $\frac{5}{6}$, together. *Anſ.* $2\ \frac{46}{120}$.
Add $1\frac{4}{11}$, $\frac{3}{7}$, and $1\frac{5}{12}$, together. *Anſ.* $1\ \frac{1935}{924}$.

CASE 3.

When the Fractions to be added are Compound, then reduce them to ſimple ones, and after this to a common Denominator: And if there be any other Fractions mixed with the Compound ones, let them alone till you have firſt reduced thoſe that are Compound, and then proceed with all of them as before directed.

Add $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{7}{8}$ and $\frac{2}{5}$ of $\frac{5}{7}$ together.
Firſt $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{7}{8} = \frac{42}{96}$, and $\frac{2}{5}$ of $\frac{5}{7} = \frac{10}{35}$; then add $\frac{42}{96}$ and $\frac{10}{35}$ together, and if you abbreviate the Fractions, it is, Add $\frac{7}{16}$ and $\frac{2}{7}$ together.
Anſ. $\frac{49}{112}$ and $\frac{32}{112} = \frac{81}{112}$.
Add $1\frac{4}{5}$ of $\frac{3}{5}$ and $\frac{5}{8}$ of $\frac{3}{7}$ and $\frac{5}{9}$ together. That is, add $\frac{12}{55}$, $\frac{15}{56}$, and $\frac{5}{9}$, together. *Anſ.* $1\ \frac{11533}{27720}$.

CASE. 4.

When there are mixed Numbers, then let the whole Numbers alone till you have reduced the Fractions to a common Denominator; then add the Numerators as before, and, if Occaſion requires, carry 1 more to the whole Numbers, as in common Addition.

Add 41 $\frac{7}{19}$ and 27 $\frac{5}{19}$ together. *Anſ.* 68 $\frac{12}{19}$.
Add 517 $\frac{2}{5}$ and 41 $\frac{3}{4}$ together. *Anſ.* 559 $\frac{3}{20}$.
Add 4 $\frac{2}{3}$, 7 $\frac{1}{2}$ of $\frac{2}{3}$, 25 $\frac{2}{7}$, and $\frac{3}{5}$ together.
Anſ. 37 $\frac{470}{1050}$.

III. SUBTRACTION of VULGAR FRACTIONS.

Sch. *How is this performed?*

Maſt. All Fractions muſt be reduced to ſimple ones, and all to a common Denominator; then ſubtract the lower from the upper Numerator, and place the Difference over the common Denominator.

From $\frac{4}{5}$ take $\frac{1}{9}$. *Anſ.* $\frac{31}{45}$.
From $\frac{14}{72}$ take $\frac{5}{72}$. *Anſ.* $\frac{9}{72}$.

But obſerve.

If the Numerator of the lower or under Fraction be larger than the Numerator of the upper Fraction, then you muſt ſubtract the lower Numerator out of the common Denominator, and take in or add the Numerator of the upper Fraction beſides, (as you do in common Subtraction when you borrow,) and remember to carry 1 for ſo doing to the lower whole Number, and then take it off the upper whole Number.

From 4 $\frac{2}{7}$ take 2 $\frac{4}{7}$. *Anſ.* 1 $\frac{5}{7}$. Now to prove this, add 1 $\frac{5}{7}$ the Difference, to 2 $\frac{4}{7}$ the leſs Number, and their Sum is = 4 $\frac{2}{7}$, the greater Number.
From 471 $\frac{14}{27}$ take 305 $\frac{19}{27}$. *Anſ.* 165 $\frac{22}{27}$.

EXAMPLE *with the Proof.*

A Merchant owes his Correſpondent 415*l.* $\frac{2}{3}$ Sterling, and he remits to him on Account 345*l.* $\frac{7}{8}$ Sterling

ling; what is there ſtill due to Balance? *Anſ.* 169*l.* $\frac{11}{24}$, viz. 169*l.* 9*s.* 2*d.* — Now to prove this, 415*l.* $\frac{1}{3}$ is 415*l.* 6*s* 8*d.* and 345*l.* $\frac{7}{8}$ is 345*l.* 17*s.* 6*d.* which taken from 415*l.* 6*s.* 8*d.* leave 169*l.* 9*s.* 2*d.* = 169 $\frac{11}{24}$.

IV. MULTIPLICATION of VULGAR FRACTIONS.

Sch. *How am I to proceed here?*

Maſt. Reduce the Compound Fractions to Simple ones; for let the Fractions be of any Denomination whatever, the Rule is ——

RULE.

Multiply the Numerators together for a new Numerator, and the Denominators together for a new Denominator.

EXAMPLES.

Multiply $\frac{4}{7}$ by $\frac{2}{5}$. *Anſ.* $\frac{8}{35}$.
Multiply $\frac{5}{9}$ by $\frac{3}{7}$. *Anſ.* $\frac{15}{63} = \frac{5}{21}$.
Multiply $\frac{14}{9}$ by $\frac{7}{12}$. *Anſ.* $\frac{98}{108} = \frac{49}{54}$.
Multiply $\frac{2}{3}$ of $\frac{1}{4}$ by $\frac{3}{5}$. *Anſ.* $\frac{6}{60} = \frac{1}{10}$
Multiply $\frac{3}{5}$ of $\frac{5}{8}$ by $\frac{2}{3}$ of $\frac{1}{4}$. *Anſ.* $\frac{30}{480}$ or $\frac{3}{48} = \frac{1}{16}$.

CASE. 2.

When the Fractions are improper, they are ſtill multiplied in the ſame Manner as in Caſe 1. and if there be mixed Numbers, reduce them to improper Fractions, and proceed as before; and if the Anſwer at laſt be an improper Fraction, reduce it to a mixt Number.

EXAMPLES.

Multiply $\frac{42}{4}$ by $\frac{3}{5}$. *Anſ.* $\frac{126}{20} = 6\frac{6}{20} = 6\frac{3}{10}$.
Multiply $2\frac{47}{5}$ by $\frac{5}{8}$. *Anſ.* $\frac{1235}{40} = 30\frac{35}{40} = \frac{7}{8}$.
Multiply $14\frac{5}{6}$ by $3\frac{1}{4}$. Theſe being reduced to improper Fractions, you muſt then Multiply $\frac{89}{6}$ by $\frac{13}{4}$.
Anſ. $\frac{1157}{24} = 48\frac{5}{24}$.

V. DIVISION of VULGAR FRACTIONS.

Sch. *How is this performed?*
Maſt. By the following

RULE.

Multiply the Numerator of the Dividend, by the Denominator of the Diviſor, and reſerve it for a new Numerator; then multiply the Denominator of the Dividend, into the Numerator of the Diviſor, for a new Denominator, and this new Fraction will be the proper Quotient or Anſwer.

EXAMPLES.

Divide $\frac{3}{4}$ by $\frac{2}{3}$. *Anſ.* $\frac{9}{8} = 1\frac{1}{8}$.
Divide $\frac{1}{2}$ by $\frac{7}{8}$. *Anſ.* $\frac{8}{14} = \frac{4}{7}$.
Divide $\frac{12}{14}$ by $\frac{3}{5}$. *Anſ.* $\frac{60}{42} = 1\frac{18}{42} = \frac{3}{7}$.
Divide $2\frac{14}{12}$ by $\frac{5}{8}$. *Anſ.* $\frac{1712}{60} = 28\frac{32}{60} = \frac{8}{15}$.
Divide $\frac{2}{4}$ of $\frac{1}{3}$ by $\frac{1}{5}$ of $\frac{3}{4}$. *Anſ.* $\frac{40}{36}$* $= \frac{10}{9} = 1\frac{1}{9}$.

* Here I abbreviate the improper Fraction firſt of all, viz. $\frac{40}{36} = \frac{10}{9}$, and ſo the Anſwer will be the eaſier found, and the Fraction after the mixt Number will be alſo leſs

N. B. There is another Way to do Diviſion, and that is, invert the Figures of the Fraction that is the Diviſor, and then multiply Numerators and Denominators together, as you did in Multiplication of Fractions. Thus, Example 1. $\frac{3}{4} \div \frac{2}{3}$ will be $\frac{3}{4} \times \frac{3}{2} = \frac{9}{8}$ as before.

Prac-

Practical Examples in Money.

Divide 4 *l.* by $\frac{1}{4}$, that is, divide $\frac{4}{1}$ by $\frac{1}{4}$.
Anſ. $\frac{16}{1} = 16 l.$*

*☞ You are here to take particular Notice, that every Quantity multiplied by leſs than Unity, decreaſes the Value; but any whole Number or Quantity divided by a Fraction or leſs than Unity, increaſes its Value as much as the Quantity is leſs than Unity; thus 4 *l.* as above divided by $\frac{1}{4}$, or 4 Times leſs than Unity, gives 4 Times as much for the Anſwer as the Dividend itſelf, viz. 16 *l.* But if 4 *l.* be multiplied by $\frac{1}{4}$, it decreaſes the Multiplicand 4 Times, viz. $\frac{4}{1} \times \frac{1}{4} = \frac{4}{4} = 1 l.$ only.

VI. The RULE of THREE in VULGAR FRACTIONS.

Sch. *I am afraid that this Rule is very hard.*
Maſt. Why ſo? It is performed the very ſame Way as the Single Rule of Three Direct; for after having made your firſt and third Number of one Name, you multiply your ſecond by your third, and divide by the firſt.

EXAMPLES.

If $\frac{3}{4}$ of a Yard coſt $\frac{3}{8}$ of a Pound Sterling, what coſt $24\frac{1}{4}$ Yards? Thus:

If $\frac{3}{4}$ ——— $\frac{3}{8}$ ——— $24\frac{1}{4}$, or $\frac{97}{4} \times \frac{3}{8} = \frac{291}{32}$, this $\div \frac{3}{4} = \frac{1164}{96}$. $= 12 l. \frac{12}{96}$ or $\frac{1}{8} = 12 l.$ 2*s.* 6*d.*

Proof by common Arithmetick.

If 3 Quarters coſt 7*s.* 6*d.* what coſt 24 Yards 1 qr.
Anſ. 12*l.* 2*s.* 6*d.* as before.

Queſtions for Trial.

If $\frac{1}{5}$ of a Yard coſt $\frac{1}{6}$ of a Pound, what muſt I give for 10 Yards? *Anſ.* 3*l.* 9*s.* 5*d.* $\frac{1}{4}$ $\frac{12}{360}$ or $\frac{1}{30}$.

If $2\frac{1}{3}$ Ells coſt $2\frac{3}{4}$*l.* what coſt $28\frac{6}{7}$ Ells?
Anſ. 34*l.* $\frac{1}{98}$.

If 1 Buſhel coſt $\frac{182}{9000}$*l.* what coſt 1 Load or 40 Buſhels?
Anſ. 7*l.* $\frac{560}{9000} = \frac{7}{12}$ 11*s.* 8*d.*

At 7*l.* $12\frac{7}{12}$ per Load, what coſt 1 Buſhel?
Anſ. $\frac{182}{9000} = 3s.\ 9d.\ \frac{1}{2}$.

What is the Intereſt of 347*l.* $\frac{5}{8}$ for 1 Year, at 4*l.* $\frac{3}{4}$ per Cent.
Anſ. 15*l.* $\frac{1335}{64000}$ or 15*l.* 4*s.* 2*d.* $\frac{400}{64000} = \frac{4}{64}$.

You may perform the Single Rule of Three Inverſe, and the Double Rule of Three, in Vulgar Fractions, with the ſame Eaſe as in common Arithmetic, if you only give proper Attention to the Fractions.

SECT. XXV.

DECIMAL FRACTIONS.

I. NOTATION of DECIMALS.

1. *WHAT do you mean by Decimal Fractions?*

Anſ. A Decimal, like a Vulgar Fraction, is a broken Number, or Part of an Integer, only with this Difference, that whereas a Vulgar Fraction has a Deno-

Denominator, a Decimal never has, at leaſt, it never has it expreſſed, but the Denominator is underſtood; and every Vulgar Fraction may be reduced or made equal to a Decimal Fraction, for in ſhort, every Decimal is but a Vulgar Fraction at beſt, as will appear by the following Obſervations.

OBSERVATION 1.

In Decimal Fractions, the Integer, or whole Thing, as one Pound, one Shilling, &c. is ſuppoſed to be divided into ten equal Parts, and thoſe Parts into Tenths, and ſo on without end. — Every Decimal Fraction is known by having a Dot or Comma, ſet or placed before it; thus .5 .25 and .75; or .05 .025 .0075, &c. are Decimal Fractions: And theſe Decimals will have each for their reſpective Denominators as follows, viz. .5 = $\frac{5}{10}$ or $\frac{1}{2}$; .25 = $\frac{25}{100}$ or $\frac{1}{4}$th, and .75 = $\frac{75}{100}$ or $\frac{3}{4}$ths: Alſo .05 = $\frac{05}{100}$; .025 = $\frac{025}{1000}$, and .0075 = $\frac{0075}{10000}$, by which you plainly ſee that the Denominator of every Decimal has as many Cyphers as there are Decimal Places, and 1 or an Unit beſides. Therefore,

OBSERVATION 2.

Every Decimal is decreaſed 10 Times in Value, by having Cyphers placed on the left Hand of it; as every whole Number is increaſed 10 Times by Cyphers on the right Hand. — Thus .1 when made .01 is 10 Times leſs; and if .001, it will be 10 Times leſs than before, and 100 leſs than the firſt; for .1 is $\frac{1}{10}$; .01 = $\frac{01}{100}$, .001 = $\frac{001}{1000}$ Parts as before; this will be very eaſily underſtood by the following Table.

TABLE.

TABLE.

Whole Numbers.							Decimal Parts.						
7	6	5	4	3	2	1	.	2	3	4	5	6	7
Millions	Hundreds of Thousands	Tens of Thousands	Thousands	Hundreds	Tens	Units		Parts of Tens	Parts of Hundreds	Parts of Thousands	Parts of Ten Thousands	Parts of Hundred Thousands	Parts of Millions

OBSERVATION 3.

From the foregoing Table it will appear by Inſpection only, that from the Place of Units, every Figure to the left Hand increaſes; but thoſe to the Right decreaſe by Tenths, viz. $\frac{2}{10}$th Parts, $\frac{23}{100}$ Parts, $\frac{234}{1000}$ Parts, $\frac{2345}{10000}$ Parts, &c.

II. ADDITION of DECIMALS.

Sch. *How is this performed?*
Maſt. By the following

RULE.

If there be only Decimals, then ſet all the firſt Figures on the left hand one under the other, and let the ſecond

ſecond and third Figures range under each other; and if there be whole Numbers, ſet them on the left Hand of the Decimals; and then add all theſe together as in whole Numbers.

EXAMPLES.

Add .1437	Add 4.71	476.0375
.0219	2.194	1.9
.0064	.72	.241
.90456	.009	3.37
.00057	5.9232	.17653
Anſ. 1.076917	*Anſ.*	*Anſ.*

Add .571, .0716, 24.719, and 243.00175 together.
Anſ. £.268.36335.

Add £4.175 .375 £41.905; £17.3175 .895, and £3.17595 together. *Anſ.* £67.84345.

III. SUBTRACTION of DECIMALS.

Sch. *How is this performed?*

Maſt. The ſame Way as common Subtraction; only you muſt mind to place the Decimals as before directed.

EXAMPLES.

From .7251	From 9.41	From 91.24
Take 07954	Take 1.97625	Take 30.00714
Anſ. .64556	*Anſ.* 7.43375	*Anſ.*

From £ 14.9235, take £ .971. *Anſ.*
From £ 376.215, take £. 174.00754. *Anſ.*

A prac-

A practical Question.

Borrowed £ 475.765, and paid three Times, each £ 150.07145, what is the Balance?
Anſ. £ 25.55065.

IV. MULTIPLICATION of DECIMALS.

Sch. *How is this performed?*
Maſt. The ſame Way as common Multiplication; for

RULE.

Multiply the two Numbers together, and then prick off as many Decimal Places in the Product as you find contained in the Multiplicand and Multiplier; and if there be fewer Decimals in the Product than are found in the Multiplicand and Multiplier, prefix a Cypher or Cyphers, to make up that Deficiency.

EXAMPLES.

Multiply	9.546	Mult.	9.546	Mult.	9.546
By	.6	by	.6	by	.06
Anſ.	57.276	*Anſ.*	5.7276	*Anſ.*	.57276*

* *Note.* Here you ſee the Figures in the Product, or Anſwer of all theſe Examples, are alike. But yet the 2d Example is 10 Times leſs than the 1ſt; and the 3d ten Times leſs than the 2d.

More

More EXAMPLES.

Multiply .9546 by .06. *Anſ.* .057276.
Multiply 72.7219 by .0012. *Anſ.* .08726628.
Multiply 725.5 by 3.7. *Anſ.* 2684.35.
Multiply .0537 by .325. *Anſ.* 0174525.
Multiply 47.25 by .00075. *Anſ.* 0354375.
Multiply 147.295 by 7.53. *Anſ.* 1109.13135.
Multiply 27.098 by 17.987. *Anſ.* 487.411726.

IV. DIVISION of DECIMALS.

Sch. *How is this performed?*
Maſt. By the following

RULE.

Divide one Number by the other as in common Diviſion; then ſubtract the Decimal Places of the Diviſor from the Decimal Places of the Dividend, and mark off as many Decimal Places in the Quotient, as are equal to the Difference.

Here follow three Examples different in Anſwer, yet the Operation of all is the ſame.

6.)57.276	by .6)57.276	by .06)57.276
Anſ. 9.546	*Anſ.* 95.46	*Anſ.* 954.6

Note 1. Here you plainly ſee I ſubtract the Decimals of the Diviſor, out of the Decimals of the Dividend, and

and dot off the Remainder; and as there are no Decimals in the Diviſor in Example 1. as 6 is a whole Number, therefore the Quotient has 3 Decimal Places as well as the Dividend.

Note 2. Obſerve alſo that in the 2d Example, the Diviſor is 10 Times leſs than in the firſt; therefore the Quotient or Anſwer is 10 Times more than in the firſt Example. In like Manner the Diviſor of the third Example is 10 Times leſs than that of the ſecond; therefore the Anſwer is 10 Times more than the ſecond Example. See Examples 1, 2, and 3, in Multiplication.

Note 3. When the Diviſor has more Figures than the Dividend; then add Cyphers to the Dividend, and proceed as before.

EXAMPLES.

Divide 56.304 by 1.84. *Anſ.* 30.6.
Divide 172.5 by 3.746. *Anſ.* 46.049.
Divide 73.486138 by 1.30526. *Anſ.* 56.3.
Divide 73.486138 by 130.526. *Anſ.* .563.
Divide 1.725 by 374.6, and have a Decimal of ſeven Places. *Anſ.* .0046049.

Here you muſt add Cyphers to the Dividend 1.725, thus 1.72500000, and you will find the Anſwer to be according to common Diviſion .46049; but there being 8 Decimal Places in the Dividend, and but 1 in the Diviſor, the Difference is 7 Places; and as there are but five Places in the Quotient, I therefore place two Cyphers before them to ſupply that Defect, and find the Anſwer to be .0046049.

VI. RE-

VI. REDUCTION of DECIMALS.

CASE I.

To reduce a Vulgar Fraction to a Decimal.

RULE.

Add Cyphers to the Numerator, divide by the Denominator, and prick or dot off as many Figures in the Quotient as you added Cyphers to the Dividend: thus the Quotient will be a Decimal equal in Value to the Vulgar Fraction given.

EXAMPLES.

Reduce $\frac{5}{8}$, $\frac{7}{8}$. and $\frac{11}{22}$ to Decimals.

OPERATION.

8)5.000	8)7.000	12)11.0000 ‡
*.625 *Anſ.*	.875 *Anſ.*	.9166 *Anſ.*

* Here you ſee $\frac{825}{10000} = \frac{5}{8}$ for $\frac{1}{8}$ of 1000 = 125, and $125 \times 5 = 625$; alſo $\frac{875}{1000} = \frac{7}{8}$.

‡ *Note* 1. The third Example has a Remainder, but after 4 Places of Figures, no Remainder is regarded, for though 8 remains, it is but $\frac{8}{12}$ or $\frac{2}{3}$ of $\frac{1}{10000}$ Part.

Reduce $\frac{57}{125}$ to a Decimal. *Anſ.* .456.
Reduce $\frac{18}{99}$ to a Decimal. *Anſ.* .1818.

Note 2. When the Quotient has not ſo many Decimal Places in it as you added Cyphers to the Numerator

merator of the Fraction; then you muſt place one or more Cyphers before the Figures in the Quotient to have a proper Anſwer.

Reduce $\frac{5}{80}$ to a Decimal. *Anſ.* .0625.

Note 3. You will ſee by the firſt Example that $\frac{5}{8} = 625$, and here $\frac{5}{800} = 0625$, and therefore $\frac{5}{8000} = 00625$, which decreaſe 10 Times.

More EXAMPLES.

Reduce $\frac{18}{6300}$ to a Decimal. *Anſ.* .002857.
Reduce $\frac{864}{2016}$ to a Decimal. *Anſ.* .4285.

CASE 2.

To find the Value of a Decimal Fraction either in Money, Weight, Time, or Meaſure.

RULE.

Multiply the given Decimal by the Number of Parts in the next inferior Denomination, and obſerve always to prick or dot off as many Decimal Parts as were in the given Decimal itſelf; then multiply thoſe Decimals by the Number of Parts in the next inferior Denomination, and ſtill continue to prick off the ſame Number of Decimals: Thus proceed, and you will have the Value of the Decimal itſelf ſtanding towards the left Hand of the Dots, and the Parts thereof towards the right Hand of the laſt Dot.

EXAM-

EXAMPLES.

1. What is the Value of .5765 of a £. Sterling?

20

11.5300

12

6.3600

4

1.4400 *Anſ.* 11 s. 6 d. $\frac{1}{4}$.

2. What is the Value of .0975 of a Guinea.

21

2.0475

12

0.5700

4

2.2800 *Anſ.* 2s. 0d. $\frac{1}{2}$.

What is the Value of .73 of a Portugal Piece?
Anſ. 26s. 1d. $\frac{2}{10}$.
What is the .375 of a Ton? *Anſ.* 7 cwt. 2 qrs.
What is the .395 of a lb. Troy?
Anſ. 4oz. 14 dwt. 19 gr.
What is the .475 of a Load? *Anſ.* 19 Buſhels.
What is the .825 of a Mile? *Anſ.* 1452 Yards.
What is the .2735 of a Year?
Anſ. 99 Days, 19 Hours, 51 Minutes, 36 Seconds.

CASE 3.

To tell the Value of a Decimal, in Shillings, Pence, and Farthings, by Inſpection only.

RULE.

1. Double the firſt Decimal Figure, and this will be the Shillings; and if the 2d and 3d Figures or the two next Figures together, do not exceed 24, count them all for ſo many Farthings; if they do not exceed 39, then count them ſo many Farthings, abating one Far-

thing; but if the next 2 Figures be from 39 to 49, then count them for Farthings, abating two, which reduce to Pence.

2. But if the 2d Figure be five or above five, then after you have doubled the 1st Figure for the Shillings, allow one more Shilling for this, and what remains carry to the 3d Figure, counting them Farthings as before directed.

CASE 4.

To reduce Pounds, Shillings, Pence, and Farthings, to a Decimal.

RULE.

Add Cyphers to the Farthings, and divide by 4, then set the Pence before this Decimal, and divide by 12; and lastly, set the Shillings before this last Quotient, and divide by 20, so shall this last Product be a Decimal equal to the given Value.

EXAMPLES.

Reduce 14 *s.* 7 *d.* $\frac{1}{4}$ to a Decimal. *Ans.* .7302.

4)1.0000		So also 17 *s.* 8 *d.* = 8833	
12)7.2500		12)80000	
20)14.6000		20)16.6666	
.7302 *Ans.*		.8833	

Note, The same is to be observed for Weights and Measures.

Reduce

Reduce 7 cwt. 2 qrs. to a Decimal. *Anſ.* .375.
Reduce 4 oz. 14 dwts. 19 grs. to a Decimal.
Anſ. .395.

VII. The RULE of THREE in DECIMALS.

Sch. *How is this Rule performed?*

Maſt. The ſame Way as the common Rule of Three Direct, by making the 1ſt and 3d Number both of one Name, &c.

EXAMPLES.

1. If .75 of a Yard coſt .25 of a Pound, what coſt 176.5 Yards? *Anſ.* £. 58.833 = 58 *l.* 16 *s.* 8 *d.*

PROOF.

.75 = $\frac{3}{4}$ or three Quarters .25 = $\frac{1}{4}$ or 1 Quarter, and 176.5 = 176 $\frac{1}{2}$ or 176.2 qrs.

Then, If 3 qrs. coſt 5 *s.* what coſt 176.2 qrs. yds.
Anſ. 58 *l.* 16 *s.* 8 *d.* as above.

2. Bought 340 $\frac{1}{8}$ yds. of Cloth, which coſt me £ 94 $\frac{7}{11}$, what did it coſt per Yard?

Say, If 340.125 yds.——£. 94.636——1 yd. *Anſ.*

3. What's the Intereſt of 347 $\frac{5}{8}$ for 2 $\frac{3}{4}$ Year, at 3 $\frac{3}{8}$ per Cent. *Anſ.* £ 15.20859375 = 15 *l.* 4 *s.* 2 *d.*

SECT. XXVI.

The SQUARE ROOT.

Sch. *WHAT is the Square Root?*

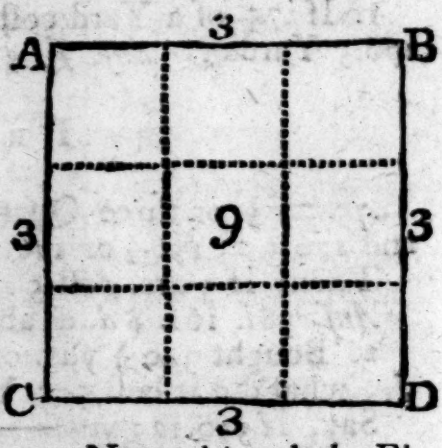
Maſt. It is that Rule, by which we find a Number, which, being multiplied into itſelf, will produce the given Number.

N. B. The Number given to be extracted is called the Square, and the Number found by ſuch Extraction is called the Root or Side of ſuch a Square, as appears by the following

TABLE.

Roots	1	2	3	4	5	6	7	8	9	&c.
Squares	1	4	9	16	25	36	49	64	81	

A farther Demonſtration of a Square and its Root.



Obſerve this Figure. You ſee I firſt draw the Line AB and divide it into 3 equal Parts; I alſo draw another Line of equal Length BD or AC which I alſo divide into three equal Parts, and then draw the pricked or dotted Lines from Side to Side, and they form 9 Squares; that is, $3 \times 3 = 9$. Now this whole Figure is called the Square itſelf, and any of the Sides, divided into three equal Parts, is called the Root or Side of the Square.

Sch. *This is very plain indeed; for I perceive if the Sides had been divided into* 4 *Parts, the Square would have had* 16 *ſmall Squares in it; and had I divided the Sides* AB *and* AC *into* 9 *equal Parts, there then would have been* 81 *Squares, becauſe* $9 \times 9 = 81$: *If it were divided into* 12 *equal Parts, then there would be* 144 *Squares produced by the Root* 12, *and in like Manner for any other Number.*

Maſt. You are right; but yet you do not know how to prove this by Figures.

Sch.

Sch. *I own it, Sir; but I hope, if you give me a few plain Directions, I shall soon be able to do so.*

Mast. I will work three different Examples, and shew you the Process of the last or most difficult of them, and the two first will then appear quite plain.

EXAMPLES.

Extract the Square Root of 144. 625 and 5525.

```
     . .                                 . .
     144(12 Root                         625(25 Root
     1                                   4       Proof
    ----     Proof.                  45 ----       25
22 | 44        12                        225       25
   | 44        12                        225      ----
    ----      ----                      ----      125
     0        144                         0       50
    ----      ----                      ----     ----
                                                  625
```

```
              . . .
              55225(235 Root
              4          Proof
             ----         235
        43 | 152          235
           | 129         ----
             ----        1175
             2325         705
       465 | 2325         470
             ----        -----
               0         55225
             ----        -----
```

PROCESS of EXAMPLE 3.

1st. I begin at the Unit's Place, and dot off every other Figure in the Resolvend or given Number; that is, I make a Dot over every other Figure.

2. I then find the nearest Root to the first Dot or Period, which here is 5, and find by the Table it will be 2 for a Root.

3. This 2 I place in the Quotient as in Division, and then

then ſquare it; and it makes 4; this I place under the 5 and ſubtract it therefrom, and bring down 1 the Remainder as in Diviſion.

4. I then take down the Figures in the next Period or Points, viz. 52, and place them by the Side of the Remainder 1, before mentioned, and it will be 152 for a Dividend.

5. Double the Root 2 (which makes 4) and place it on the Left Hand of the Dividend 152 for a Diviſor.

6. Aſk how many Times the Diviſor 4 is contained in the two firſt Figures of the Dividend 152, viz. 15, and it will be 3, which alſo place in the Root on the right Hand of the 2, and likewiſe on the right Hand of 4 the Diviſor, which will then be 43.

7. Multiply this Diviſor 43 by the Root 3, and it will make 129, which take from 152 and there remains 23; to this bring down the laſt 2 Figures in the third Point or Period, viz. 25, and place them on the right Hand of 23, and it will be 2325.

8. Now you muſt do as in the 5th Direction, viz. double the Root; but whereas you only doubled 2 at firſt you muſt now double the whole Root or Quotient Figures 23, which is 46, and then aſk (as in Direction 6th) how many Times 46 you can have in 232 (rejecting the laſt Figure 5) and it will be 5 Times, which 5 place alſo in the Quotient for another Root Figure, and alſo on the right Hand of the new Diviſor 46, which will then be 465.

9. Multiply 465, this laſt Diviſor, by 5, the laſt Figure of the Root, and it gives 2325, which taken from 2325 leaves (o) for a Remainder: So is the Work compleated.

Laſtly. Thus you may with Eaſe extract the Square Root of any Number, only by taking down Period after Period, after doubling the Root and proceeding as before.

Note 1. There will be always as many Figures in the Root as you have Dots over the ſquare Number given. Thus in Example 1 and 2 you have 2 Dots only, therefore the Roots contain but 2 Figures, viz. 12 and 25; in the 3d Example you have 3 Dots, therefore you have 3 Figures in the Root, viz. 235.

Maſt. Do you underſtand this?

Sch. *Very plainly, Sir; but let me aſk one Queſtion; ſuppoſe there be a Remainder after I have extracted through all the Points, how then?*

Maſt. Never mind that, for in proving the Work you only ſquare the Root, *viz.* multiply it by itſelf, and take in the Remainder (if any) as you do in Diviſion.

EXAMPLES.

4. What is the Square Root of 119025?
Anſ. 345.

5. What is the Square Root of 106929?
Anſ. 327.

6. What is the Square Root of 106954?
Anſ. 327 and 25 remains.

7. What is the Square Root of 119164?
Anſ. 345 and 139 remains.

8. What is the Square Root of 36372961?
Anſ. 6031.

9. What is the Square Root of 22071204?
Anſ. 4698.

Note 2. When there is a Remainder, and you want to come nearer the Truth, then add Cyphers to the Reſolvend or given Number, and extract as before, but remember you muſt always add an even Number of Cyphers, and you will have as many Decimal Places in your Root as you have Dots or Periods over the Figures in your Reſolvend.

EXAM-

EXAMPLE.

10. What is the Square Root of 43623 ?

I add Cyphers and it is 43623.000000; the Root of which is 208.861.

11. What is the Square Root of 10 ? *Anſ.* 3.1622.

N. B. No Regard is paid to the Remainder after you have gone the Length of 3 or 4 Decimals.

Note 3. When you are required to extract the Square Root of a Vulgar Fraction, you muſt extract the Roots of the Numerator and Denominator, and if nothing remains, theſe Roots will be a new Numerator and a new Denominator.

12. What is the Square Root of $\frac{625}{55225}$?

Anſ. $\frac{25}{235}$.

Note 4, When the Root of the Vulgar Fraction cannot be extracted without a Remainder, then reduce the Vulgar Fraction to a Decimal, and extract the Root as if it were a whole Number.

13. What is the Square Root of $\frac{7}{8}$ths ?

$\frac{7}{8}$ = .8750000 whoſe Root is .2958.

One Example for Practice.

14. I demand the Square Root of 97546105778997104 1.

Anſ. 987654321.

Sch. *I'll have a Trial at it very ſoon.*

Maſt. If you can work this perfectly, you will not be

be at a Loſs for any Thing in this Rule; therefore we will proceed to ſhew you

The Uſe of the SQUARE ROOT.

Sch. *What is the Uſe of this Rule?*

Maſt. It is to find the Sides of all Manner of Squares; to find the Sides of right angled Triangles, and Mean Proportionals, to determine Heights and Diſtances, and many other uſeful and neceſſary Things in the Buſineſs of Life and Trade.

1. *To find a Mean Proportion between two Numbers.*

Multiply the Numbers together and extract the Square Root of them for a true Mean.

1. What is the true Mean between 12 and 3? *Anſ.* 6.
2. What is the Mean between 40 and 20? *Anſ.* 28.28.
3. What is the true Mean Proportional between 325 and 177? *Anſ.* 239.84.

2. *Having the Area (or Content) of a Circle, Square, Triangle, or any other Figure given, to find the Side of a Square that ſhall be equal thereto.*

This is done only by extracting the Square Root of the Area given, and the Root will be the Side of a Square that is equal to the Area of the given Figure.

1. There is a Circle, Oval, or Triangle, whoſe Area or ſuperficial Content is 60025, I demand the Side of a Square which ſhall be equal thereto? *Anſ.* 245.

2. A certain Number of Perſons were in Company, and ſpent between them 30 Shillings and a Penny, and every

every Man paid an equal Share, and as many Pence a-piece as there were Men in Company. I demand the Number of Men, and how much each paid?

Anſ. 19 Men, 19 Pence each.

3. A Company of Grenadiers behaved ſo extremely well in a Battle, that their General gave them 12 Guineas and 1 Penny to be equally divided among them, and every Man was to have as many Pence as there were Men in Company. I demand the Number of Men, and how much each had?

Anſ. 55 Men, 55 Pence a-piece.

4. There is a Circle whoſe Area is 3960: I demand the Side of a Square equal thereto? *Anſ.* 62.9.

5. A General of an Army of 65536 Men wants to draw them up in a ſquare Order for Battle. I demand how many muſt ſtand Rank and File? *Anſ.* 256.

6. A General of an Army, having 16200, would place them in an oblong Square (viz. in a long Square Form) ſo that the Number of Men in every Rank may be double to the Number of Men in File; how many muſt there be in Rank, and how many in File?

Anſ. 180 in Rank, (that is in the Front ſtanding Side by Side) and 90 in File, that is Depth or ſtanding behind each other.*

* Here the Rank is required to be double the File; therefore take $\frac{1}{2}$ of 16200 and extract the Square Root of it, and it will be 90 for the File, and this doubled gives 180 for the Rank.

N. B. If there were required to be 3 or 4 Times as many in Rank as in File, then divide the given Number by 3, 4, &c. and extract the Root, as before, for the File, which multiplied by 3, 4, &c. gives thoſe in the Rank.

7. I demand how many Square Yards of Ground 180 Men in Rank, and 90 Men in File, will take up, ſuppoſing them to ſtand diſtant from each other 3 Feet?

Anſ. 53271 Square Feet = 5913 Square Yards.

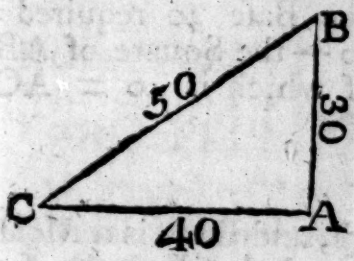
N. B. Theſe and ſuch Sort of Queſtions do not require an Extraction of the Square Root, but they are very uſeful in many Reſpects, ſuch as in ſetting out of Plants and Trees at any Diſtance, to know how much Ground they will take, and the Rule for finding it is this,

RULE.

As 1 is to the Diſtance between any 2 Bodies (which here is 3) ſo is the Length planted leſs 1 to a 4th Number, and as 1 to the Diſtance of each, ſo is the Breadth leſs 1 to a 4th Number; the Product of theſe 2 gives the Quantity of Ground required.

3. *Having the 2 Sides of any right angled Triangle given, to find the other Side.*

Definition.



A Triangle conſiſts of 3 Sides, *viz.* the *Cathetus* or perpendicular AB, the *Baſe* AC, and the *Hypothenuſe* or ſlanting Side BC, called by ſome the Diagonal.

CASE. I.

Having the Perpendicular AB and Baſe AC given, to find the Hypothenuſe.

Add the Squares of the Perpendicular and Baſe together, and extract the Square Root of their Sum, and this will give the Hypothenuſe.

In the above Triangle AB = 30, whoſe Square is 900 and AC = 40, whoſe Square is 1600; now 1600 + 900 = 2500, whoſe Square Root (√) is = 50 the Hypothenuſe BC required.

CASE. 2.

Having the Hypothenuſe BC and Perpendicular AB, to find the Baſe AC, or having BC and CA given, to find the Perpendicular AB.

RULE.

From the Square of the Hypothenuſe take the Square of the Baſe, and extract the Square Root of the Remainder, and this will give the Perpendicular. Thus, 50 × 50 = 2500 the Square of BC, 40 × 40 = 1600 the Square of AC, now 2500 — 1600 = 900 whoſe √ Square Root is = 30 = AB the Perpendicular required: Or from the Square of the Hypothenuſe ſubtract the Square of the Perpendicular, and the Square Root of the Remainder gives the Baſe 40 required: thus, the Square of BC = 2500 — the Square of AB 900 = 1600 the Square Root of which is 40 = AC required.

There is a Tower 60 Feet high, and there is a Moat round it 44 Feet wide. I demand the Length of a Scaling Ladder, which will reach from the Edge or Verge of the Moat to the Top of the ſaid Tower.

Anſ. 74.4 Feet. This is done by Caſe the 1ſt.

SECT.

SECT. XXVII.

The CUBE ROOT.

Sch. *WHAT is a Cube?*

Maſt. It is a Solid, made or generated from a Line and a Square; that is, let there be a Line 3 Inches or 3 Feet long, as

AB or BC, whoſe Square, or Superficies, will be 9, (as by the 1ſt Figure in the Square Root) then this Square 9 multiplied into the Depth AE, DF, or CG = 3, will give 27 the ſolid Contents of the Cube itſelf, whoſe Sides every Way are = 3; for 3 × 3 = 9, and 9 × 3 = 27, the Cube itſelf, whoſe Root is 3, as appears by the following

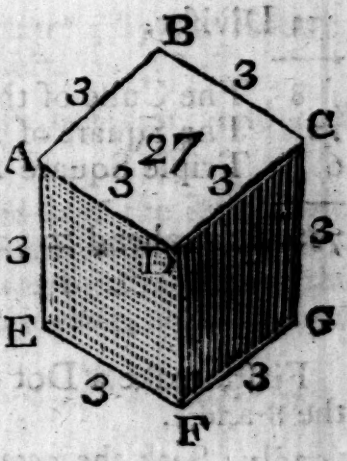


TABLE.

Roots	1	2	3	4	5	6	7	8	9
Squares	1	4	9	16	25	36	49	64	81
Cubes	1	8	27	64	125	216	343	512	729

Sch. *I underſtand this Table perfectly.*

Maſt. Then we will proceed to ſhew you how to extract the Cube Root of any Number, which, though much more difficult than the Square Root, yet may be eaſily done by Obſervation and Practice.

EXAMPLES.

I demand the Cube Root of 1728? *Anſ.* 12.

1728	12 Root, *Anſ.*	*Proof*
1		Root 12
		12
728	Reſolvend	144
		12
3	Triple Quotient	
3	Triple Square	Cube 1728
33	Diviſor.	
8	The Cube of the Root 2	
12	The Square of 2 by trip. Quotient	
6	Triple Square × Root 2	
728	Subtrahend = 728 Reſolvend.	

The Proceſs.

Firſt, make a Dot over every 3d Figure, *viz.* over the 8 and 1.

2dly. Seek the neareſt Root to the firſt Point 1, (as you did in the Square Root,) and it is 1; which put in the Root or Quotient, and place it alſo under the 1 in the 1ſt Point, and ſubtract it therefrom, and there remains (0) in this Example.

3dly. Take down the Figures in the next Point, viz. 728, and call that the Reſolvend.

4thly. Triple the Root Figure 1, and place it under the Tens Place of the Reſolvend, and call it the triple Quotient 3.

5thly. Square the Root or Quotient 1, and then triple that Square, and ſet it one Place more to the left Hand, and call it the triple Square 3.

6thly. Add theſe two together as they ſtand, and they make 33 for a Diviſor.

7thly,

7thly. Aſk how many Times 33, the Diviſor, may be had in the Reſolvend 728, rejecting the laſt Figure 8, (as in the Square Root) viz. 72, and it will be 2, which alſo place in the Root.

8thly. Cube this laſt Root Figure which will be 8, and place it under the Units Place of the Reſolvend.

9thly. Multiply the Square of the Figure laſt put in the Root (viz. 4.) into the triple Quotient 3, which is 12, and ſet it one Place more to the left Hand, as in Multiplication.

10thly. Multiply the triple Square 3 by the Root 2, and ſet it one Place more to the Left.

11thly. Add theſe 3 Numbers together, and call them the Subtrahend 728.

12thly. Subtract the Subtrahend from the Reſolvend, and if any Thing remains, and there be any more Figures or Points, bring them down by the Side of the Remainder, and call it New Reſolvend, and proceed n every Reſpect as before.

2. I demand the Cube Root of 185193? *Anſ.* 57.

Another Way to extract the Cube Root.

3. I demand the Cube Root of 103823? *Anſ.* 47.

The Work.

103823 { 47 Root, *Anſ.**
64

39823 Reſolvend or Dividend

4800 Diviſor

Add { 33600 = 4800 × 7
5880 = 7 × 7 × 4 × 30
343 The Cube of 7

39823 Subtrahend = the Dividend.

* *Rule and Proceſs.*

1. Point off every 3d Figure as before, and find the greateſt Cube of the firſt Point 103, which is 4, whoſe Cube is 64; place this under as before.

2. Subtract 64 from 103, and to the Remainder take down the 2d Point or Period, and it will be 39823 for Dividend or Reſolvend.

3. Square the Root Figure 4, and multiply it by 300, and place it under the Dividend or Reſolvend for a Diviſor.

4. Try how many Times the Diviſor is contained in the Dividend, which here is 7, and place this alſo in the Root, by the Side of the 4.

5. Multiply the Diviſor by this Root Figure 7, and place it under the Diviſor, viz. 33600.

6. Square the laſt Figures in the Root, and multiply the Square by the 1ſt Figure, (or Figures, if more than one) and then by 30, and place this under the laſt, Units under Units, Tens under Tens, &c. viz. 5880.

7. Take the Cube of the laſt Figure, which is 343, and place it under the laſt Sum.

8. Add theſe 3 together as they ſtand, and call the Sum the Subtrahend, which being equal to the Reſolvend 39823, the Work, you ſee, is finiſhed, and 47 is the Cube Root of 103823.

Laſtly, If there had been a Remainder, and more Figures, or Points, to take down, you muſt have brought the next Period down, and proceeded as before; but in that Caſe you muſt have worked with the 2 firſt Figures in the Root, inſtead of the 1ſt only, &c.

Sch.

Sch. *I like this Way very well.*

Maſt. In ſome Caſes it is the eaſieſt; but you may take which you pleaſe.

More EXAMPLES.

4. What is the Cube Root of 32461759? *Anſ.* 319.
5. What is the Cube Root of 259694072? *Anſ.* 638.
6. What is the Cube Root of 5213714904?
Anſ. 1734.
7. What is the Cube Root of 219365327791?
Anſ. 6031.
8. What is the Cube Root of 9423479350146861?
Anſ. 211221.

Note 1. If there be Decimals in the Sum, its Cube Root is found out in the ſame Manner; only you muſt take care to prick off the Decimals right.

9. What is the Cube Root of 32.461759?
Anſ. 3.19.

Note 2. If Cyphers are required to be added, you muſt add 3 Cyphers, 6 Cyphers, 9 Cyphers, &c. increaſing by 3 always.

10. What is the Cube Root of .002? Add Cyphers, dot them off thus 002000000000, and the Anſwer will be .1259 and 4383021 remains.

Note 3. To extract the Cube Root of a Vulgar Fraction, extract the Cube of the Numerator and Denominator, and this will give a new Numerator and Denominator for the Anſwer; but if the Fraction be a Surd, (i. e. a Number, whoſe Root can never be exactly found) then reduce it to a Decimal, and proceed as in the laſt Example.

The

The Uſe of the Cube Root.

1. There is a Piece of Timber 45 Inches long, 27 Inches broad, and 23 Inches thick; how many ſolid Feet and Inches does it contain?

Anſ. 27945 ÷ 1728 = 16 ſolid Feet and 297 ſolid Inches.

2. A Gentleman has a Cellar dug 20 Feet long, 17 Feet wide, and 8 Feet deep; how many ſolid Feet were taken out of it? *Anſ.* 2720 ſolid Feet.

3. There is a cubical Stone, whoſe Contents are 19683 Inches; I demand the Area or ſuperficial Contents of any Side? *Anſ.* 729.

4. There is a Globe whoſe ſolid Contents are 103823; I demand the Side of a Cube whoſe Contents ſhall be equal to the ſaid Globe?

Note 4. All ſimilar Solids are to each other, as the Cube of their Sides, Diameters, &c. therefore,

As the Cube of the Side or Diameter of the given Body, is to its Weight, ſo is the Cube of the Side or Diameter of the Body to its particular Weight.

5. There is a Bullet 3 Inches Diameter, and weighs 4lb. I demand the Weight of a Bullet whoſe Diameter is 6 Inches? *Anſ.* 32lb.

Firſt, Cube the Diameter of each; then ſay, As the Cube of the Diameter of the given Bullet is to its Weight, ſo is the Cube of the Body required, to its Weight.

Note 5. From hence it appears, that a Pipe or a Cube, whoſe Diameter is only as large again as another, will diſcharge 8 Times the Water in the ſame Time that the ſmaller Pipe will do, becauſe the Solidity is 8 Times as much, whereas to Perſons unacquainted with theſe Things

Things it would appear capable of diſcharging only as much again. — See the two next Examples which were put in Practice not far from London.

6. A certain Company agreed with another Company to have 2 Pipes fixed in the River, the Bore of each to be 4 Inches Diameter; but afterwards this Agreement was made void, and they were to have one Pipe only of 8 Inches Diameter; I demand who were gainers by the Bargain; or which diſcharged moſt Water, the 2 Pipes of 4, or the one of 8 Inches Bore?

Anſ. The Pipe of 8 Inches Bore diſcharged 4 Times the Quantity of both the other; for $4 \times 4 \times 4 = 64 \times 2 = 128$ cubic Inches only; but $8 \times 8 \times 8 \times = 512$ Inches $= 128 \times 4$. Thus was one Company deceived or over-reached by the Cunning of the other, or rather their own Ignorance.

7. A Farmer being out of Hay, went to another Farmer in the Neighbourhood, who had ſeveral large Stacks, and begged he would lend him 10 ſolid Feet, and he would pay him 5 Feet in a Week's Time, and 5 Feet the Week following: No, ſays the covetous Griper, (thinking to make an Advantage of his poor Neighbour) if you will ſend me back 5 Feet every Week for 4 Weeks, I'll lend it you: The other ſaid it was hard, but as he wanted it he muſt agree to it; accordingly he had the Hay, and paid it as agreed to. I demand how many Feet were lent, and how many paid, and who was the Sufferer?

Anſ. The covetous Lender was the Sufferer, for he had but $\frac{1}{2}$ his Hay back again, though he thought he had as much again. For $10 \times 10 \times 10 = 1000$ Feet; and $5 \times 5 \times 5 = 125$: Now $125 + 125 + 125 + 125 = 500$ only.

6. There is a Ship of 300 Tons Burthen, whoſe Keel is 75 Feet long, Breadth of the Beam 29.5 Feet, and Depth of the Hold 14 Feet; I demand the Length, Breadth,

Breadth, and Depth of another Ship of the ſame Mould, whoſe Burthen is to be 500 Ton?

Anſ. Length 88.9 Feet, Breadth 35.75 Feet, and Depth 16.3 Feet.

To find two mean Proportionals between two Numbers.

RULE.

Divide the greater Number by the leſs, and extract the Cube Root of the Quotient; which Root multiplied by the leſs Extreme, gives the leſs Mean; and this Mean, multiplied into the Root again, gives the greater Mean.

7. I demand what are the 2 true Mean proportional Numbers between 9 and 576?

Anſ. 36 and 144. For $576 \times 9 = 5184$, and $144 \times 36 = 5184$.

Thus have I given you a ſufficient Number of Examples.

SECT. XXVIII.

Containing a Variety of uſeful and practical Queſtions, to exerciſe the Scholar in the foregoing Rules.

1. WHAT Number is that, which, if divided by 245, will produce 1764? *Anſ.* 432180.

2. What Number is that, which, if multiplied by 245, will produce 432180? *Anſ.* 1764.

3. In 57 Crowns, how many Shillings, Pence, and Farthings? *Anſ.* 285*s.* 3420*d.* and 13680 *farth.*

4. In 42848 Farthings, how many Pence, Crowns, and Pounds? *Anſ.* 10712*d.* 178 *Crowns*, and 2*s.* 8*d.* and 44*l.* 12*s.* 8*d.*

5. I demand how many Crowns, Half-Crowns, Shillings, and Pence, of each an equal Number, will pay a Debt of 133*l.* 18*s.*? *Anſ.* 312 of each.

6. In

6. In a Year (viz. 365 Days 6 Hours) how many Minutes? *Anſ.* 525960.

7. Bought 12 Firkins of Butter, each 56 lb. which coſt me 11*l.* 4*s.* what is it per lb? *Anſ.* 4*d.*

8. A General laid out 6000*l.* in cloathing 1480 Men; I demand what the Cloathing of each coſt? *Anſ.* 4*l.* 1*s.* and 3 *farth.*

9. If 6 Ells of Holland coſt 1*l.* 13*s.* how much will 16 Pieces, each 27 Ells, coſt, at the ſame Rate? *Anſ.* 118*l.* 16*s.*

10. A Linen-Draper laid out 82*l.* 10*s.* in fine Cambrick; there were 5 Rolls or Pieces, each 22 Yards long; what did it coſt him per Yard? *Anſ.* 15*s.*

11. A Woollen-Draper bought of a Clothier 8 Bales of Cloth, each containing 6 Pieces, and each Piece 27 Yards, and gave 16*l.* 4*s.* for every Piece; I demand what the Whole coſt, and what it coſt per Yard? *Anſ.* The Whole coſt 777*l.* 12*s.* and 1 Yard coſt 12*s.*

12. A Perſon becomes a Bankrupt and owes in all 2980*l.* 11*s.* 8*d.* but his Effects amount only to 931*l.* 8*s.* 7*d.* $\frac{3}{4}$; I demand what the Creditors will receive in the Pound? *Anſ.* 6*s.* 3*d.*

13. Bought 3 Hhds. of Tobacco, each weighing 13 cwt. 1 qr. 19 lb. which coſt 281*l.* 16*s.* 3*d.* I demand what this is per lb? *Anſ.* 15*d.*

14. A Gentleman has an Eſtate of 424*l.* 7*s.* 2*d.* $\frac{1}{4}$. and his Expences every Day, one with another, are 13*s.* 11*d.* I demand what he ſaves, or lays up, at the Year's End? *Anſ.* 170*l.* 7*s.* 7*d.* $\frac{1}{4}$.

15. A Gentleman ſtands daily at the Charges of 2*l.* 15*s.* 9*d.* and at the Year's End lays up 340*l.* what is his yearly Income? *Anſ.* 1357*l.* 8*s.* 9*d.*

16 An Engliſh Man of War took a Spaniſh Prize worth 5440*l.* There were 320 Sailors beſides the Captain, who had $\frac{1}{5}$ of the Prize, and every Sailor had an equal Share of the Remainder. I demand the Cap-

Captain's and each private Sailor's Share? *Anſ.* The Captain had 1088 *l.* and each Sailor 13 *l.* 12 *s.*

17. What is the Intereſt of 457 *l.* 14 *s.* 6 *d.* for 2 Years 6 Months, at 5 *l.* per Cent. per Annum? *Anſ.* 57 *l.* 4 *s.* 3 *d.* $\frac{3}{4}$.

18. A Uſurer put out 750 *l.* for 12 Months, and then received for Principal and Intereſt together 810 *l.* I demand what Rate per Cent. he received for Intereſt? *Anſ.* 8 *l.* per Cent.

19. If Cwt. of Cinnamon coſt 59 *l.* 14 *s.* 8 *d.* and 76 lb. of Mace coſt 40 *l.* 10 *s.* 8 *d.* I demand what they coſt per Ounce, one with the other? *Anſ.* 8 *d.*

20. A Lady by Will left a particular Acquaintance of her's a very rich Cabinet valued at 400 *l.* with all the Effects in it; the Cabinet contained 32 Drawers, each of which had a Purſe of 100 Guineas; the Lady to whom this Legacy was left had in the Bank 1000 *l.* and 240 *l.* in Caſh at Home; I demand her Fortune? *Anſ.* 5000 *l.*

21. What is the Value of 148 Pieces of Holland, each 24 Ells long, at 4 *s.* 2 *d.* per Yard? *Anſ.* 925 *l.*

22. How many Gallons of Brandy, at 8 *s.* 4 *d.* per Gallon, may I have for 148 Pieces of Holland, each 24 Ells, at 4 *s.* 2 *d.* per Yard? *Anſ.* 2220 Gallons.

23. A Perſon purchaſed 478 *l.* in a public Stock, and let it continue 15 Years before he demanded Principal or Intereſt; and then he received in Principal and Intereſt 836 *l.* 10 *s.* I demand at what Rate per Cent. the Intereſt was? *Anſ.* 5 *l.* per Cent.

24. What Part of 50 is $\frac{5}{8}$ths? *Anſ.* 31 $\frac{1}{4}$.

25. A Linen-Draper bought a Quantity of Iriſh and Holland together, which coſt him 148 *l.* 10 *s.* the Quantity of Iriſh was 540 Yards, at 3 *s.* per Yard; and he had $\frac{1}{2}$ as much Holland as Iriſh: I demand what the Holland coſt in all? and what it coſt per Yard? *Anſ.* The Holland coſt 67 *l.* 10 *s.* at the Rate of 5 *s.* per Yard.

26. A bought of B 2 Pieces of Ivory; the one was 14 Inches long, 7 Inches wide, and 2 Inches thick; the other was 16 Inches long, 5 Inches wide, and 3 Inches thick: I demand how many Dozen of Dice, each $\frac{1}{4}$ of an Inch every Way may be made out of them?

Anſ. 581 Doz. $\frac{1}{3}$ or 4 over.

27. How many Crowns, Half-Crowns, Shillings, Six-pences, Three-pences, Pence, Half-pence, and Farthings, of each an equal Number, will pay a Debt of 70*l.* 9*s.* 4*d.* $\frac{1}{2}$. *Anſ.* 150 of each.

28. A Grocer laid out 26*l.* 16*s.* 8*d.* for 5 cwt. of Tobacco, of different Kinds, viz. at 9*d.* 10*d.* 12*d.* and 15*d.* per lb. and was to have an equal Quantity of each; I demand what Quantity he had of each Sort? *Anſ.* 140*l.*

29. What is gained in laying out 500*l.* if 1*s.* brings me in 16 Pence? *Anſ.* 166*l.* 13*s.* 4*d.*

30. A Perſon becomes a Bankrupt for 1187*l.* 8s. and all his Effects amount only to 445*l.* 5*s.* 6*d.* I demand what this will pay in the Pound? *Anſ.* 7*s.* 6*d*

31. Bought a Quantity of Paper for 580*l.* and 3 Months after ſold it for 649*l.* 12*s.* I demand what I gained per Cent. by it? *Anſ.* 12*l.* per Cent.

32. Two Men, A and B, depart from one Place; A ſets out 8 Days before B and travels 15 Miles a Day, and B travels 20 Miles a Day; I demand in how many Days B will overtake A, and how far they have then both travelled? *Anſ.* B overtakes A in 24 Days, and both have then travelled 480 Miles.

33. Two Travellers, A and B, depart from one Place, but quite contrary Ways; A goes 14 Miles a

Day, and B 17 Miles a Day; I demand how far they are diſtant from each other a Week after their firſt ſetting out? *Anſ.* 217 Miles.

34. Two Men, A and B, ſet out to travel by Agreement for 12 Days; the firſt Day they went both 20 Miles very lovingly, but B complained he could not go at that Rate, therefore they took their own Pace; A went 17 Miles a Day, and B 12 Miles a Day; I demand how far, or what Diſtance A was before B, or, which is the ſame, how far B was behind A?
Anſ. 55 Miles.

35. A Gentleman who has an Eſtate, what with Taxes and other Charges, ſtands at the Expence of 19*s.* 4*d.* per Day, and at the Year's End lays up 147 *l.* 3 *s.* 4*d.* I demand the Value of his Eſtate? *Anſ.* 500*l.* a Year.

36. If 12 Men dig a Trench in 20 Days, in how many Days will 60 Men do the ſame? *Anſ.* In 4 Days.

37. If when Flour is ſold for 18 Pence per Peck, the Penny Loaf weighs 10 oz. what ought it to weigh when the Flour is 2 *s.* per Peck? *Anſ.* 7½ oz.

38. How many Yards of Matting, ½ Yard wide, will cover a Paſſage 20 Feet long and 6 Feet broad?
Anſ. 26 Yds. 2 Feet.

39. If 20 Acres of Graſs be mowed by 8 Men in a Week, how many Acres may be mowed by 48 Men in a Fortnight? *Anſ.* 240 Acres.

40. How many Tiles, 10 Inches long, and 8 wide, will cover a Floor or Side Wall 22 Feet long and 15 Feet broad? *Anſ.* 594.

41. What

41. What Number or Fraction is that, which, multiplied by $\frac{3}{5}$, will produce an Unit or 1 only? *Anſ.* $\frac{5}{3}$.

42. What Number is that, which being multiplied by $\frac{3}{5}$ will produce the ſame Number as there are Farthings in a Pound? *Anſ.* 1600.

43. If $\frac{5}{8}$ of a Yard coſt $\frac{2}{3}$ of a Pound Sterling, what coſt $\frac{1}{3\,2}$ of a Yard? *Anſ.* $\frac{8}{240}$, or 8 *d.*

44. If $\frac{1}{3}$ of an Ounce coſt $\frac{7}{8}$ of a Shilling, what coſt $\frac{5}{6}$ of a Pound? *Anſ.* 1 *l.* 15 *s.*

45. A Perſon left an Eſtate of 3000 *l.* to his 3 Daughters, A, B, and C: in ſuch a Manner that for every 3 *l.* that A had, B was to have 5. and C 8; I demand the Share of each? *Anſ.* A 562 *l.* 10 *s.* B 937 *l.* 10 *s.* and C 1500 *l.*

47. Divide 1063.89825 by 41.7215. *Anſ.* 25.5.

48. What is the Product of 41.7215 multiplied by 2.55? *Anſ.* 106.389825.

49. Divide 200.0625 by 24.25. *Anſ.* 8.25.

50. Bought 148.275 Yds. of Cloth, which coſt me 175 of a Pound per Yard; what did they come to?

Anſ. 25 *l.* 18 *s.* 11 $\frac{1}{2}$ *d.*

51. What preſent Money will diſcharge a Debt of 550 *l.* 10 *s.* due 9 Months hence, at 15 per Cent. or what Rebate muſt I have for prompt Payment, viz. paying my Money 9 Months before it is due?

Anſ. The Preſent Money is 334 *l.* 4 *s.* 4 *d.* and the Rebate for prompt Payment 16 *l.* 5 *s.* 8 *d.*

52. A advanced the Sum of 450 *l.* 10 *s.* for B upon a Building Leaſe, to be paid in 5 Years Time after the Rate of 6 *l.* per Cent. compound Intereſt; I demand what the Principal and Intereſt will amount to in that Time? *Anſ.* the Principal and Intereſt will be 602 *l.* 17 *s.* $4\frac{3}{4}$ *d.* and the Intereſt alone 152 *l.* 7 *s.* $4\frac{3}{4}$ *d.*

53. Two Partners, A and B, entered into Partnerſhip, and between them bought 20 Bags of Hops, which coſt 200 *l.* of which A paid 120 *l.* and B 80 *l.* and they gained by them 50 *l.* I demand the Share of each in the Gain? *Anſ.* A's Share of the Gain is 30 *l.* and B's 20 *l.*

54. Three Partners A, B, and C, buy a Ship jointly, and afterwards freight her for a Voyage: A put in 234 *l.* B put in 351 *l.* and C put in 702 *l.* and upon her Return having made up their Accounts, they find the Gain 792 *l.* I demand the Share of each?

Anſ. A 144 *l.* B 216 *l.* and C 432 *l.*

55. Two Partners entered into Trade; A put in 200 *l.* for 6 Months, B put in 750 *l.* for 4 Months; after which they ſettle and find they had gained 700 *l.* I demand the Share of each in Proportion to his Stock and Time?

Anſ. A's Share is 200 *l.* and B's 500 *l.*

56. A Mealman mixes 40 Buſhels of Meal at 5 *s.* with 72 at 3 *s.* with 80 at 2 *s.* per Buſhel: I demand what a Buſhel of this Mixture is worth? *Anſ.* 3 *s.*

57. A Grocer mixes 4 Sorts of Tea, ſome of 4 *s.* 3 *d.* ſome of 6 *s.* 9 *d.* ſome of 7 *s.* 6 *d.* and ſome of 5 *s.* per lb. ſo as to make a Mixture which may be worth 6 *s.* per lb. How many Pounds of each muſt he take?

Anſ. 9 lb. of 4 *s.* 3 *d.* 21 lb. of 6 *s.* 9 *d.* 12 lb. 7 *s.* 6 *d.* and 18 lb. of 5 *s.*

58. A

58. A and B barter; A ſells B 160 Dozen of Candles at 4*s.* 6*d.* per Dozen, and B pays him in Part 15*l.* in Caſh, and is to diſcharge the Remainder of the Debt in Tobacco at 8*d.* per lb.? I demand how much Tobacco A muſt have?

Anſ. 5 cwt. 2 qrs. 14 lb.

59. How many Buſhels of Wheat at 4*s.* 2*d.* per Buſhel, may I have for 48 Ells of Holland at 3*s.* 4*d.* per Yard? *Anſ.* 48 Buſhels.

60. A and B barter; A has broad Cloth worth 14*s.* per Yard ready Money, but in Barter he will have 15*s.* 6*d.* B has Hops worth 4*l.* 18*s.* per Cwt. ready Money; what muſt he advance his Hops per Cwt. to equal the Advance of A's Cloth in Barter?

Anſ. To 5*l.* 8*s.* 6*d.* per Cwt. ſo that the Advance is 10*s.* 6*d.* per Cwt.

61. How many Palermo Florins, at 15*d.* each, muſt I receive for a Bill of 175*l.* Sterling?

Anſ. 2800.

62. A Church-warden made a Rate for Diſburſements, in repairing the Church, which amounted to the Sum of 93*l.* 15*s.* the Amount of the Rents of the Pariſh is 2500*l.* I demand what his Rate muſt be in the Pound, to raiſe what he diſburſed, and what a Farmer muſt pay who rents 100*l.* a Year.

Anſ. the Rate is 9*d.* in the Pound, and the Farmer pays to it 3*l.* 15*s.*

63. A Labourer agreed with a Farmer to threſh him 100 Buſhels of Wheat and Barley, and to receive 3*d.* per Buſhel for the Wheat, and 2½*d.* per Buſhel for

the Barley; when the Whole was done he received 1 *l.* 2*s.* 6*d.* I demand how many Buſhels of each he threſhed?

Anſ. 40 Buſhels of Wheat and 60 Buſhels of Barley.

64. Three School-boys, A, B, and C, were talking about their Ages, ſays B to A, I am juſt half as old again as you; ſays C to B, and my age is juſt half the Sum of both yours; well ſays A, I remember I heard my Maſter ſay, who is now 46, that he is one Year older than all of us: I demand the ages of A, B, and C? *Anſ.* A *is* 12, B, 18, *and* C 15.

65. What Number is that to which if you add 24 and take 17 out of that Sum, then multiply the Remainder by 6, and divide that Product by 8, the Quotient will be 39? *Anſ.* 45.

66. A Perſon dying left 2 of his Acquaintance, A and B, a certain number of Queen Anne's Crown-pieces; now had he left 10 Crowns more to A, and 10 leſs to B, then A would have had 5 Times as many as B; but had he left 10 leſs to A, and 10 Crowns more to B, then both would have had an equal Number: I demand how many each had left him? *Anſ.* A *had* 40, *and* B 20.

67. As I was beating on the Champaign Grounds,
Up ſtarts an Hare before my two Greyhounds:
The Dogs being light of Foot did fairly run,
Unto her 18 Rods juſt 21:
The Diſtance that ſhe ſtarted up before,
Was meaſured 90 Rods, nor leſs nor more:
Now this I'd have you unto me declare,
How far they run before they caught the Hare;

Anſ. 320 *Rods.*

68. I demand the Square Root of 36481? *Anſ.* 191.

69. I demand a mean proportional Number between 30 and 70? *Anſ.* 59.16 + 94ths.

70. There

70. There are two Numbers, the one 40, the other twice as much: What is the Difference between their Sum and Difference? *Anſ.* 80.

71. There is a Tower, which has a Spire ſtanding in the Middle, the Tower itſelf is 125.11 Feet high, and from the Center of the Spire, to the Edge or Verge of the Tower is 30 Feet, and from the top of the Spire to the ſaid Verge of the Tower 100 Feet: I demand the Height of the Spire ſeparately, and the whole height from the Ground. *Anſ. The Spire is* 95.39 Feet. *Both together* 220.5 Feet.

72. There is a Parallelogram or long Table, whoſe Length, is 10.125 Feet, and its Breadth 8 Feet: I demand what muſt be taken off from the Length, and what added to the Breadth to make it a ſquare Table?

Anſ. 1.125, viz. 1 Foot 1 $\frac{1}{2}$ Inch muſt be taken from the Length and 1 inch added to the Breadth to make it a ſquare Table, for $9 \times 9 = 10.125 \times 8 = 81$ the Contents.

73. There is a Circle whoſe Area is 1357.25, I demand the Side of a Square equal thereto?

Anſ. 36.84+644 Remainder.

74. At the coming over of the Palatines there was a certain Number lodged in an Out-Building, for whom a Subſcription was opened, and there was gathered 3 *l.* 15 *s.* and it was agreed to give every one of them as many Pence as there were Perſons in Number: I demand the Number of Perſons, and how much each had? *Anſ.* 30 Palatines, 30 Pence each.

75. What is the Square Root of .00125?

Anſ. .015.

76. What

76. What is the Square Root of $\frac{1}{4}$? *Anſ.* $\frac{1}{2}$.

77. What is the Square Root of 3?

Anſ. 1.732+176 Remains.

78. What is the Cube Root of 1875? *Anſ.* 15.

79. I demand the Cube Root of 2924307?

Anſ. 143.

80. There is a Sphere or Globe, whoſe ſolid Content is 76.765625: I demand the Side of a Cube, whoſe ſolid Contents ſhall be equal to that of the Sphere or Globe? *Anſ.* 4.25 or $4\frac{1}{4}$.

81. There is a Shot or Bullet whoſe Diameter is 4 Inches, and it weighs 18 lb. I demand the Weight of another Bullet of the ſame Caſt and Metal, whoſe Diameter is 6 Inches? *Anſ.* 60.75=$60\frac{3}{4}$ lb.

82. There is a Shot 4 Inches Diameter, and its Weight 18 lb. I demand the Weight of one of the ſame Sort 3 Inches Diameter?

Anſ. 7.59575 lb.=7 lb. 9 oz. 8 drms.

83. There are 2 Shots or Bullets; one is 4 Inches Diameter; and it weighs 18 lb. the other weighs $60\frac{3}{4}$ lb. I demand its Diameter? *Anſ.* 6 Inches.

84. There are 2 Shots one of 4 Inches Diameter, and weighs 18 lb. the other weighs 7 lb. 9 oz. 8 drms. I demand its Diameter? *Anſ.* 3 Inches.

Here

Here follow ſome critical and ſpeculative Queſtions, which (though they fall not under any one particular Rule, nor are immediately neceſſary in Trade or Buſineſs, yet) are very proper to exerciſe the Mind of every Pupil that would make himſelf Maſter of Arithmetic.

N. B. Before I begin theſe Queſtions, I think it may not be amiſs to take Notice of the different Opinions of different Tutors and Schoolmaſters; ſome ſay, that nothing difficult ſhould be offered to young Pupils, becauſe it damps and diſcourages their little Minds, and hinders their Purſuit of, and Progreſs in Learning.—Others affirm, that it is impoſſible to make a Pupil Maſter of any Branch of Learning, unleſs he be often puzzled.—Now though I do not pretend to determine this Matter, by Way of dictating to them, who have the Care of Youth (as it would be impoſſible to chime in with all) yet I would beg Leave to ſay, that both Aſſertions may be right and that both Sorts of Tutors may be very well juſtified in their different Methods of Teaching: For 1ſt, As it is univerſally agreed, that no Tutor nor Maſter can be too plain in teaching the firſt four Rules of Arithmetic and the Rule of Three, neither can any Scholar be too perfectly grounded in them: becauſe they are the Baſis of all ſucceeding Rules. So, 2dly, after it is found that the Scholar is perfect in theſe, it will then be high Time to exerciſe his Mind in Things which require more Thought and Attention, and therefore to ſet him Queſtions too eaſy, is only trifling both with his Time and Capacity; for ſuch aſpiring Youths ſhould certainly be encouraged and ſet forward in their Purſuits, and have other Sorts of Queſtions ſet them than what they can immediately ſolve with Eaſe. I ſay, that it is the ſame with Learning as in any Mechanical Trade: When any Apprentice is perfect in ſuch and ſuch a Part of his Buſineſs, if his Maſter ſtops him there, he will never be an expert Workman; nor can he ever attain to that Character till he both ſees and executes ſomething in a more maſterly Manner.—It is therefore on this

this Account, I have thought it really neceſſaay to propoſe the following Queſtions, to exerciſe the Minds of ſuch as are already perfect in all the foregoing Rules, and as for thoſe young Tyroes who are not acquainted with Arithmetic in general, I take it for granted that no wiſe Tutor would offer to propoſe Queſtions of this Sort to them. With regard to thoſe Perſons, whoſe Bent of Inclination is ſet upon Variety, theſe Queſtions will ſerve as proper Exerciſes for them at Intervals, and be no Doubt of great Service.

More Examples for Trial.

1. Suppoſe 4 Times 8 be (or produce) 32; how much then will the Square of 15 be? *Anſ.*

2. A Linnen-Draper bought 3000 Yards of Dowlas, for which he was to pay 93 *l.* 15*s.* but by his paying ready Money was allowed 2 *l.* 1*s.* 8 *d.* Rebate. I demand what it coſt per Yard? *Anſ.* 11 *d.* $\frac{1}{4}$.

3. What is the Difference between the Number of Hour-Strokes which a Clock ſtrikes in a whole Day, and the Square Root of 24336? *Anſ.*

4. Two Travellers A and B, ſet out to travel the ſame Way round an Iſland, 80 Miles in Circumference: A goes 20 Miles a Day, and B goes 15, and they both agree to travel in this Manner till A overtakes B, how far muſt each travel, and how many Times went they round the Iſland?

Anſ. A overtook B in 16 Days, and thenhad been 4 Times round the Iſland, or had travelled 320 Miles; and B had been 3 Times round it, or had travelled 240 Miles.

5. There

5. There was a Bridge built over a large River from County to County, which by the Eſtimation of the Workmen came to the Sum of 65,520 *l.* and there were Commiſſioners appointed to receive a Toll of the Paſſengers as follows, viz. for every 4 Wheel Carriage 4 *d.* for every 2 Wheel Carriage 3 *d.* for every Horſeman 1 *d.* and for every Foot Paſſenger an Half-penny. Now at the End of the firſt Month or 28 Days, the Toll-keepers had collected juſt 760 *l.* and had taken Notice that as often as 3 paſſed over in a 4 Wheel Carriage, 8 paſſed over in a 2; and as often as 1 paſſed over in a 4 Wheel Carriage, 10 paſſed over on Horſeback, and 10 Times that Number on Foot: The Queſtion is how many paſſed over of each Sort in the Month?

Anſ. 2400 4 Wheel Carriages, 6400 2 Wheel Carriages, 24000 on Horſeback, and 240000 on Foot: For 240000 Half-pence + 24000 Pence + 6400 Three-pences + 2400 Groats = 760 *l.*

6. A Man and his Wife had 3 Sons, A, B, and C, whoſe Ages bore the following Proportion to each other: B was 3 Times as old as C, and if B's Age had been multiplied by the Square Root of the Age of A, it would have given the Father's Age, and if the Ages of B and C had been multiplied together, it would have equalled the Age of the Mother: Now the Ages of the Father and Mother were 108, and all their Ages 149; I demand the Age of each ſeparately?

Anſ. The eldeſt A was 25, B 12, C 4, the Father 60, the Mother 48.

7. A Jack Tar dying on Ship-board, left 177 *l.* to 6 of his Comrades (A, B, C, D, E, and F) his Ship-mate, and his Widow as follows: To A a certain Sum, to B 2 *l.* 10 *s.* more, and ſo on, every one to have 2 *l.* 10 *s.* more than the preceding one: To the Ship-mate he left double the Sum of all their Legacies, and to his

his Widow 40*l.* 10*s.* leſs than to the Ship-mate. I demand the Share of each?

Anſ. A 1*l.* B 3*l.* 10*s.* C 6*l.* D 8*l.* 10*s.* E 11*l.* F 13*l.* 10*s.* the Ship-mate had 87*l.* and his Widow 46*l.* 10*s.*

8. A young country 'Squire came to London, and having more Money than Wit, went to *White's* where he met with 4 noted Gamblers, A, B, C, and D, with whom he ſat down ſeparately to play at Cards. A won half what he had got in his Pocket, and genteelly returned him back 20 Guineas; then he played with B for half he then had, who beat him and civilly returned the 'Squire back 10 Guineas; then C beat him juſt the half of what he had left, and kindly returned him back 5 Guineas; and at laſt he played with D till he loſt half what he then had left, and he alſo returned him back 5 Guineas: Then our young 'Squire thought proper to leave off, and upon telling his Money, found he had juſt 25 Guineas left: I demand what Sum he had when he ſat down to play, and what he loſt in all?

Anſ. He had 210*l.* when he began, and loſt 183*l.* 15*s.*

SECT. XXIX.

Containing ſome neceſſary *Inſtructions* in MENSURATION.

AS this ſmall Treatiſe may fall into the Hands of many Perſons who would be glad to have ſome Inſight into the Art of meaſuring Surfaces and Solids, viz. Carpenters, Joiners, Glaziers, Painters, Plaiſterers, Paviors, Bricklayers, &c. I thought it would

would be very acceptable to lay down the proper Rules, and give a few Examples for the Benefit of thoſe whoſe Buſineſs require this Kind of Aſſiſtance; and even to ſuch as have no Occaſion for theſe Things, this Section will probably be neither altogether uſeleſs nor unentertaining.

I. Of CROSS MULTIPLICATION:

Sometimes called

MULTIPLICATION of DUODECIMALS.

This conſiſts of Feet, Inches, and Parts of an Inch, viz. 12 Parts make 1 Inch, 12 Inches 1 Foot.

Croſs Multiplication is performed 2 different Ways; the firſt by Multiplication, the 2d by Multiplication and Diviſion, like Practice. The firſt is the moſt common Way; but the 2d, (in my Opinion) is the beſt, being eaſier upon the Whole and much ſhorter.

Rule for the firſt Way.

1 Feet × or multiplied by Feet produce Feet.
2 Feet × Inches produce Inches.
3 Inches × Inches produce Parts of an Inch.
All of which (except Feet × Feet) are to be divided by 12, if the Product be 12, or above 12; Thus,

Feet × Inches ÷ 12 produce Feet and Inches, and Inches × Inches ÷ 12 produce Inches and Parts.

EXAMPLE.

There is a Floor whoſe Length is 47 Feet, 8 Inches, and its Breadth 9 Feet, 4 Inches; I demand the Contents?

	F. I.
The Work	47.8
by	9.4
	423
	6.
	15.8
	.2.8
	444.10.8

First 9 × 47 Feet = 423 Feet: 9 Feet × 8 Inches = 72 Inches = 6 Feet. Then 47 Feet × 4 Inches = 188 Inches = 15 Feet 8 Inches, and laſtly, 8 Inches × 4 = 32 Parts of an Inch = 2 Inches 8 Parts.

The ſecond Method.

RULE.

Multiply the laſt or ſmaller Denomination of the Multiplicand, by the greater or firſt Denomination of the Multiplier, carrying 1 for every 12 (according to the firſt Direction) then take the even Parts of the next leſſer Part as in the Rule of Practice, and divide the top Numbers or Multiplicand by thoſe even Parts, and ſet down the whole Number; if any Thing remains, reckon the Figures as ſo many Times 12, and take the Parts of them as before, and always remember that you do by 12 at every one of the Denominations.

The former Example worked according to the ſecond Method.

	F. In.
Multiply	47.8
by	9.4
	429
$\frac{1}{3}$ |	15.10.8
	444.10.8

First

First multiply 47 Feet 8 Inches by 9 Feet, ſaying, 9 Times 8 is 72 Inches, which is juſt 6 Feet; then 9 Times 7 is 63, and 6 I carried is 69; 9 and carry 6, then 9 Times 4 is 36 and 6 is 42; thus 47.8 × 9 Feet = 429 Feet; then for the 4 Inches, I ſay, 4 Inches is $\frac{1}{3}$ of a Foot (as in Practice) and take $\frac{1}{3}$ of 47, I find it 15 Feet and 2 Feet over, to which I take in the 8 Inches, and it is 2 Feet 8 Inches = 32 Inches, of which I take $\frac{1}{3}$ and find it 10 Inches and 2 over, which 2 Inches × 12 make 24 Parts, the $\frac{1}{3}$ of which is 8 Parts, and thus is the ſame Queſtion performed in 2 Lines, which by the firſt Rule took 4 Lines. **

** Mr. *Wingate* and many others, tho' they often uſe the firſt Way, yet in any long and difficult Queſtions have Recourſe to this ſecond Method: See his Examples in Pages 384, 385, and 386.

2. Plaiſterers and Painters take their Dimenſions in Feet and Inches, but calculate by the Square Yard, viz. 9 Square Feet 1 Square Yard. There is a Room 94 Feet 6 Inches round, and 10 Feet 9 Inches high (to be painted) I demand how many ſquare Yards it contains? *Anſ.* 1015 Ft. 10 In. 6 Pts. = 182 Yds. 7 Ft. 10 In. 6 Pts.

A Gentleman had a Court Yard paved with Scotch Pebbles; it was 216 Feet 4 Inches long, and 116 Feet 6 Inches wide: I demand how many ſquare Yards it contained? *Anſ.* 2608 Yards, 2 Feet.

3. *Of Flooring, Tyling, Thatching, &c.*

The Dimenſions here are taken in Feet and Inches, but are caſt up by the Square, viz. 10 Feet Square = 100 Feet which is called 1 Square.

RULE.

Multiply the Length by the Breadth and divide by 100.

A Thatcher new thatch'd the Roof of a Barn; the Length was 65, and the Breadth from the Top of the Roof to the Eaves, 25 Feet; how many Squares did it contain?

Anſ. 16.25 Squares = 16 $\frac{1}{4}$.

4. *Of Brick Meaſure.*

This is perform'd by the Rod Square, viz. 16 $\frac{1}{2}$ × 16 $\frac{1}{2}$ Feet = 272 $\frac{1}{4}$ Feet, which makes 1 Square Rod of Brick-work at 1 $\frac{1}{2}$ Brick thick, called Standard Meaſure.

RULE. 1.

Multiply the Length by the Breadth and divide by 272.25 (or by 272) and this will give the Contents.

1. There is a Wall 97 Feet long, 16 Feet high, and 1 $\frac{1}{2}$ Brick thick; I demand how mady Square Rods it contains?

Anſ. 5 Rods $\frac{7}{10}$, or 5 Rods 190 Feet and a Half, if you divide by 272.25. But if you divide by 272 only (which is near enough) it will be 5 Rod 192 Feet for the Contents.

RULE 2.

When the Wall is more or leſs than 1 $\frac{1}{2}$ Brick thick, it is then ſaid to be out of the Standard, and muſt be reduced to the Standard of 1 $\frac{1}{2}$ Brick. Thus,

As 3, the Number of half Bricks in the Standard, to the Number of half Bricks in the given Wall, ſo are the Contents at 1 $\frac{1}{2}$ Brick thick, to a Wall of any given Thickneſs.

Then ſuppoſe a Wall of the ſame Length and Height as the foregoing, and 2 $\frac{1}{2}$ Brick thick; what are the Contents?

The Contents at 1 $\frac{1}{2}$ Brick thick were found to be 5 Rods, 7 Tenths. Then ſay,

As 3 : 5 : : 5.7 : 9.5. That is, the Contents at 2 $\frac{1}{2}$ Bricks thick are 9 $\frac{1}{2}$ Rods.

Again,

Again, Suppoſe the ſame Wall only 1 Brick thick, ſay, As 3 : 5.7 :: 2 : 3.8. The Contents therefore at 1 Brick thick, will be 3 Rods, 8 Tenths, and thus for any Thickneſs.

RULE 3.

But there is yet another Method, and that is by having proper Diviſors at any Thickneſs; for having multiplied Length by Heighth as before: Then,

For Bricks Thick.		*Divide by.*	
Standard	1	*Meaſure*	408.39*
	1½		272.25
	2		204.2
	2½		163.35
Brick thick	3	*Divide by*	136.12
	3½		116.68
	4		102.1
	4½		90.75
	5		81.75

N. B. If you caſt away the Decimal, and divide by the whole Number only, it will do for common Uſe.

* Thus if we take the former Example at 1 Brick thick only: I then ſay 97 × 16 = 1552; which divided by 408.39 (the Diviſor for 1 Brick thick) gives 3 Rods, 8 Tenths; and for 2 ½ Bricks thick, I divide by 163.35 and have 9 Rods, 5 Tenths, viz. 9 ½ Rods as before.

OBSERVATION.

From what has been ſaid it will evidently appear, that after having found the Contents of any Piece of Brick Work according to the Standard of 1 ½ Brick thick, the Contents may be very eaſily found at every other Thickneſs by the following Table, which alſo ſhews the Reaſon of the former Diviſors.

TABLE.

	Bricks thick.		
For	1 *ſubtract*	⅓	*This will reduce any Thickneſs to the Standard of* 1 ½ *Brick Thick.*
	2 *add*	⅓	
	3 *multiply by*	2	
	4½ *mult. by*	3	
	6 *mult. by*	4	

Thus the Contents of the foregoing Wall at 1 ½ Brick thick (or Standard) was found to be 5 Feet, 7 Tenths; therefore for 1 Brick thick ſubtract ⅓ which is 1.9 Tenths: Now 5.7 — 1.9 = 3.8 viz. 3 Feet, 8 Tenths, as before.

5. *Of digging Wells, Vaults, or Cellars.*

The Dimenſions muſt be taken in Feet and Inches, in Length, Breadth, and Depth; and the Anſwer is given in ſolid Yards, viz 27 Feet, 1 ſolid Yard.

RULE.

Multiply the Length, Breadth, and Depth into each other, and divide the Product by 27, and this will give the Contents.

There is a Cellar 9 Feet long, 7 Feet 6 Inches broad, and 4 Feet 6 Inches deep; I demand how many ſolid Yards of Earth were dug out of it?

Anſ. 11 ¼ Yards.— For 9 × 7.5 × 4.5 = 303.75 which ÷ 27 = 11.25 or 11 ¼.

6. *Of Board or ſuperficial Meaſure.*

RULE.

If the Board is all of one equal Breadth, then multiply the Length in Feet by the Breadth in Inches, and divide by 12, and you will have the Contents in Feet, and the Remainder in Inches, or parallel Elogram, 12 to a Foot: Or multiply the Length in Inches by the Breadth in Inches, and divide by 144, the Number of Inches in a ſquare Foot, and this will give the Contents in Feet, and the Remainder in ſquare Inches.

EXAMPLE 1.

There is a Board 10 Feet long, and 14 Inches broad; I demand the Contents?

Anſ. 11 ⅔ Feet.

Or by the ſecond Way, 10 Feet, or 120 In. × 14 = 1680 Inches, which ÷ 144 = 11 Ft. 96 Inches, viz. 11 ⅔ as before.

Of

Of Tapering Boards.

When a Board is much wider at one End than the other, it is cuſtomary with moſt Workmen to add the Widths of both Ends together, and take the Half of that Sum for a mean Breadth throughout; multiply this by the Length, and the Product will be the Contents.

EXAMPLE.

There is a Plank or Board 12 Feet long, and the Breadth at one End is 16 Inches, and at the other but 8 Inches. I demand the Contents?

$16 \times 8 = 24$, the Half of which is 12; then $12 \times 12 = 144$, which divided by 12 gives juſt 12 ſquare Feet.

7. *Of Timber or ſolid Meaſure.*

As to regular round Timber of one Girth only, the Method is, with a ſmall String or Cord, to take the Circumference of the Tree in any convenient Place agreed upon, and having found how many Inches there are in this Circumference, to divide them into 4 Parts, or take the $\frac{1}{4}$ of them, and that Number is called the Girth.

RULE.

Square the Girth in Inches, that is, multiply it by itſelf, and multiply that Product by the Length of the Tree; divide this by 144, and that will give the Contents.

EXAMPLE.

There is a Tree 96 Inches in Circumference (or 24 Inches Girth) and 18 Feet in Length; I demand the Contents? *Anſ.* 72 Feet.

Note, It is cuſtomary, in large Trees or Pieces of Timber, to make an Allowance of 1 Inch for the Bark of a Tree: So that if the Girth be 24 as above, it is called 23.

Note, In ſome Places 40 Feet make a Load, in others 50 Feet: Add the Contents of all the Trees together, and divide by 40 or 50, and this will give Loads.

Of

Of round tapering Timber.

In Meaſuring long Trees it is common to make a Mark with-Chalk at any convenient Place, and ſuppoſe it to be 2 Trees; then to take the Girth of each, and meaſure them as 2 diſtinct Trees; and adding their Contents together, this will give the Contents of the Tree.

Or you may take the Girth at 3 or 4 different Places, add them all together, and divide their Sum by the Number of Girths you have taken, which will give a mean Girth; and this multiplied by the Length, and divided by 144, will give the Contents.

8. *The Uſe of the common two Feet Slip Rule in meaſuring Board, Timber, &c.*

Deſcription of the Rule.

The Rule and Slip are marked 1, 2, 3 to 9; and then it begins from 9 to repeat 1, 2, 3, &c. again.

1. Now ſuppoſe I call the firſt Figures 1, 2, 3, one, two, three, &c. then when I come to the (1) which ſtands in the Middle of the Rule, it is evident that ſtands for 10, the two ſtands for 20, the three for 30, and if I call the firſt one (1) on the Rule Ten (10) the Two (20) &c. then the middle One will become a Hundred (100) 2 200, 3 300, &c. and the Halves and Quarters muſt be reckoned for 50 and 25. A little Practice will make it eaſy.

2. On this Rule you will find the 4 following Letters, A, B, C, and D, two of which, viz. A and D, are on the Rule itſelf, and the other two B and C, are on the little Side or Slip, and the reſpective Lines on the Rule or Slip, belonging to ſuch Letter or Letters, anſwer to the Rule of Proportion or Rule of Three Direct, as will evidently appear by the following Proceſs.

To multiply by the Rule.

Set 1 marked on the Slip B, againſt the Multiplicand on the Rule or Line A; then againſt the Multiplier upon the Line B ſtands the Product or Anſwer on the Line A.

EXAM.

EXAMPLES.

Multiply 9 by 5. Set 1 on B to 9 on A; then againſt 5 on B you will find 4 and 5 Strokes or Diviſions, which 4 is the 40 and the Diviſions 5, viz. 45.

2. Multiply 16 by 15. *Anſ.* 240.

3. Multiply 45 by 36. *Anſ.* 1620.

Diviſion by the Rule.

This is only the Reverſe of the former: For ſet the Diviſor found on the Line B, againſt 1 on the Line A, then againſt the Dividend on B will be the Quotient on A.

Divide 45 by 9. *Anſ.* 5.

Divide 240 by 16. *Anſ.* 15.

The Rule of Three by the Slip.

Set the 1ſt Number on B to your 2d Number on A, then againſt your 3d Number on B will be your Anſwer on A.

EXAMPLES.

If 1 lb. of Coffee coſt 4 Shillings, what coſt 9 lb.?
Anſ. 36 Shillings.

If 1 lb. of Tea coſt 5 *s.* 6 *d.* what coſt 24 lb.?
Anſ. 132 *s.* or 6 *l.* 12 *s.*

If 4 lb. of Tobacco coſt 7 *s.* what coſt $\frac{1}{4}$ of Cwt.
Anſ. 49 Shillings.

Of ſuperficial Meaſure by the Rule.

N. B. The Lines A and B are uſed for Boards, or ſuperficial Meaſure, and C and D for Timber or ſolid Meaſure.

RULE.

Set the Length of the Board on the Line B, againſt the Number 12 on A; then againſt the Breadth on the Line B is the Anſwer on A.

EXAMPLES.

What are the Contents of a Board 5 Feet long and 9 Inches wide?
Anſ. 45 Inches = 3 Feet, 9 Inches.

There

There is a Board 9 Feet long and 10 Inches wide; I demand the Contents?

Anſ. 90 Inches = 7 Feet, 6 Inches.

Of Timber or ſolid Meaſure by the Rule.

This is performed very readily by the common Method, on the Line C and D, as follows:

Set the Length of the Tree found on the Line C, right againſt 12 on the Line D (wrote upon the Edge Girth Line) then againſt the Girth itſelf on C, you have the Contents in Feet and Inches on the Line D.

Suppoſe a Tree 36 Inches round (viz. 9 Inches Girth) and 8 Feet long, what are the Contents?

Anſ. 4 ½ ſolid Feet. For,

Set 8 on C to 12 the Girt Center on D; then againſt 9 the Girt itſelf on C, you have 4 ½ Feet on D, the Contents required.

Note. The Rule now ſtanding, as it is, you may ſuppoſe 8 Feet long to be 80, then the Content will be 10 Times more, viz. 45 Feet.

There is a Tree 20 Feet long, and 10 ¾ Inches Girt; what are the Contents?

Anſ. 16 Feet, 7 Inches.

Thus my dear *Tyro*, I have endeavoured to give you a juſt Idea, or Conception of Things in general; if you want more tell me freely.

Scholar. Sir, you are extreamly obliging, and I accept your kind Offer, by deſiring ſome ſhort Informations in Guaging.

Maſter. You have your Requeſt; but the Inſtructions and Examples muſt be very ſhort; yet your Care and Diligence may make up for their Deficiency.

9. *Of Gauging.*

Gauging is the Art which teaches us to tell the Area and Contents of any Veſſel, be it Cooler, Tub or Caſk in Ale or Wine Gallons; as alſo to tell the Contents of any Ciſtern or Couch of Malt in Corn Buſhels.

N. B

N. B. Area ſignifies the Contents, or what the Veſſel holds, at 1 Inch deep only; and the Contents are found by the multiplying the Area by the Depth.

1. *To gauge a Square, or any Parallelogram or Long Square.*

Multiply the Length in Inches, taken within-ſide by the Breadth in Inches, and divide by 282 for Ale Gallons, by 231 for Wine, and by 2150 for Malt or Corn Buſhels.

EXAMPLE.

There is a Parallelogram or Cooler, whoſe length is 40 Inches, its Breadth 22.3 Tenths, and its Depth 9 Inches; I demand the Area and Contents in Beer and Wine Gallons, and Corn Buſhels?

Anſ. Area for Ale is 3.16 Gallons, for Wine 3.86, and for Malt Buſhels .4146. — Theſe ſeparately multiplied by Depth 9 Inches will give the true Contents for Ale Gallons 28.44, for Wine 34.74, and in Buſhels 3.726.

By the Slip Rule for Ale Gallons.

Set 282 upon B, againſt 22.3 on A; then againſt 40 the Length on B is 3.16 on A as before.

For Wine Gallon.

Set 231 (the Inches in a Wine Gallon) upon B to 22.3 on A; then againſt 40 on B, is 3.86 on A as before.

For Malt Buſhels.

Set 2150 (the Inches in a Buſhel) upon B, to 22.3 upon A; then againſt 40 on B, you will find .414 a Decimal for the Area.

To find the Area of a Circle.

Square the Diameter, and divide that Product by 359 for Ale Gallons; by 294 for Wine, and by 2737.47 for Buſhels.

EXAMPLE.

Let there be a Cylindrical Tub (viz. one whoſe top and bottom Diameters are alike) ſuppoſe 3 Feet, 4 Inches

4 Inches = 40 Inches, and the Depth 20 Inches, I demand the Area and Contents in Beer and Wine Gallons, and Corn Buſhels?

OPERATION.

Diameter 40 × 40 = 1600 (to which add Cyphers for the Decimal Parts) which divide by 359, and it gives 4.456 Gallons Area for Ale: The ſame divided by 294 gives 5.4489 Gallons for Wine; and dividing the ſame by 2737.47 you have .584 for the Malt Buſhels: Theſe ſeverally multiplied by the Depth 20, give 89.12 Gallons of Ale, 108.978 Gallons of Wine, and 11.68. Buſhels.

Area by the Slip Rule for Ale.

Set 359 upon B to 40 the Diameter on A, then againſt 40 on B, is 4.4 Parts on A, or near a Half.*

* N. B. I have put only 4 and 4 Parts, becauſe, on the Rule, the Learner cannot judge of, or perceive any more Decimal Parts than one in general.

For Wine.

Set 294 upon B, to 40 upon A; then againſt 40 on B, is 5.4 Gallons on A.

For Buſhels.

Set 2737.47 (or, 2737) on B to 40 on A; then againſt 40 on B you'll find .58 or near .6 on A.

To gauge Caſks in general.

Firſt take the Diameter or Depth of the Caſk at the Bunghole from Inſide to Inſide, as alſo the Diameter at the Head: Then ſquare them both; and to twice the Square of the Bung Diameter, add the Square of the Head Diameter: Then multiply this Sum by the Length of the Caſk in Inches, and divide the Product by 1077 (which is 359 × 3) and this will give the Contents in Ale Gallons. Divide by 882 (viz. 3 Times 294) and it will give the Contents in Wine Gallons.

EXAM-

EXAMPLE.

There is a Caſk whoſe Bung Diameter is 34 Inches, Head 24, and Length 48; I demand the Contents?

Anſ. 128.7 = 128 Gall. 5 Pints Ale, and 157.17 = 157 Gall. 1 Pint, Wine.

The ſame by the Sliding Rule.

You remember I told you that the proper Diviſors to find the Area of Circles in Ale or Wine Gallons are 359 and 294: Now the Square Root of theſe Numbers is 18.94 and 17.14 which are called Gauge Points on the Rule on the Line D: Therefore

For Ale.

Set 18.94 (or 19) on the Line D to the Length on C; then againſt the mean Diameter (viz. 28.56) on D, you will find 128.7 Gallons as above.

For Wine.

Set 17.14 on D to the Length on C; then againſt the Mean Diameter 28.5 on D, is 157 on C, the Wine Gallons required.

N. B. The Diviſor for Malt Buſhels for Squares is 2150; and the Gauge Point 46.36; for Circles 2737.47 whoſe Square Root is 52.32 a Gauge Point.

Thus have I, *Tyro*, given you a few brief Examples of the principal Rules of Arithmetic; and if you properly attend to them, you will ſoon become Maſter of this uſeful Art. Farewell.

PART II.

Containing a ſhort and eaſy Sketch of BOOK-KEEPING; ſo properly adapted to the Capacities of Youth, that they may ſoon learn to keep any common Accompts of ſimple Debtor and Creditor with great Eaſe and Exactneſs.

1. OF all the Branches of Learning, none certainly has been more neglected, or leſs attended to, both by adult and young Perſons, than the common Method of *Book-Keeping*; for this has been a Complaint of a very long ſtanding, and the not teaching Youth ſomething of this neceſſary Branch of Knowledge, has been Matter of Surprize to many People.

2. Some Maſters and Teachers may perhaps ſay, what ſignifies teaching Youth to keep common Accompts, without the Parents Conſent that they ſhould learn *Book-keeping* according to the *Italian* Method, namely by *double Entry*, commonly called or known by the Name of MERCHANTS ACCOMPTS; but this is a vague Way of talking, for I may as well ſay, what ſignifies teaching Youth the firſt four Rules of *Arithmetic*, the *Rule of Three*, *Practice*, &c. unleſs they learn *Algebra*? Every Body knows that a Perſon may be a very good *Arithmetician*, and perfectly qualified for any Buſineſs, where Accompts are required, without *Algebra*; though he cannot ſolve abſtruſe and difficult Queſtions in *Geometry*, &c. without it.

In like Manner, though a Perſon cannot keep large Accompts of Merchandiſe without double Entry; yet he may keep common Accompts of ſimple *Debtor* and *Creditor* very exact by ſingle entry only.

3. It is plain then, that the Errors of common Tradeſmen and Artificers, ſuch as *Butchers*, *Bakers*, *Blackſmiths*, *Tailors*, &c. &c. do not ſo much lie in their keeping Accompts by *ſingle* Entry only, as in keeping no Account at all, or a partial, falſe, or incorrect Book; for it is evident, that if any Perſon ſets down all that he buys and ſells, and what he receives and pays for it (though it were but in *one* common Day-book only) his Accompts would be juſt in reſpect to his Circumſtances in Trade, though it will be troubleſome to ſettle them, by Reaſon of many different

ferent Accompts being mixed together; yet, notwithſtanding this, it would be a juſt and true Account.—But in order that there may be no difficulty on account of the Length and Prolixity of the common Day-book, it is very proper there ſhould be another larger Book provided, called the Ledger; into which every Man's Accompt is to be transferred under a ſeparate Head, as will be ſhewn hereafter.

4. Plain and ſimple as this Method may appear, yet I will venture to ſay, if it be duly obſerved according to the following Plan (from which any one may vary at Pleaſure) it will be found uſeful, as it is notoriouſly evident, that after Boys have been a long Time at School, and gone through moſt of the Branches of common *Arithmetic*, they are not ſometimes able to caſt up the Side of a Ledger, much leſs to know how to ſet Articles down in the Day-book, and poſt them up.

5. From whence then can this Deficiency in Youth ariſe? Certainly from their having no Inſtructions in the common Method of Book-keeping; and ſimple and mean as it may appear at firſt Sight, yet I am fully convinced, that Examples and Exerciſes of this Sort would be very ſerviceable to Youth, and redound greatly to the Credit of Teachers and Tutors in general. For,

6. It is really a Shame to hear ſuch daily Complaints of the Deficiency of Education, and that after Youth have been both at Day Schools and Boarding Schools for Years, and have learnt almoſt every Rule of common *Arithmetic*; yet if they are put to ſettle a plain Accompt, or even to make out, and caſt up a long Bill of various Articles, you are certain to find them at a loſs; the Parent or Maſter is ſurprized, wonders the Lad cannot perform it; and being aſked the Reaſon, the innocent School-Boy naturally anſwers, that he was never taught ſo *far*, (which is generally true) or never was taught ſuch a Thing at all.

Laſtly, Is it not then highly neceſſary that this neglected Branch of Education ſhould become a Matter of ſerious Conſideration in ſome Reſpect or other? I have given the Hint only, and introduced it imperfectly in the following Sketch; but I may poſſibly, in ſome future Work, give a more perfect Treatiſe upon this Subject.

The DIARY, or DAY-BOOK,

COMMENCING

JANUARY 1st, 1765.

Note 1. A Dash, or sloping Stroke, placed between the Figures is used for Expedition Sake to part the Shillings from the Pence, thus 4 | 10, 14 | 8½ and 19 | 5, signify 4*s.* 10*d.* 14*s.* 8*d.*½. and 19*s.* 5*d.*

Note 2. When you remove the Articles of any Accompt from the Day-book into the Ledger, it is called *posting*, and after you have transferred each Article to every Man's separate Accompt in due Order, you then make this Dash or Tick (✓).

Note 3. Between one Day of the Month and another make a Partition, or leave a Line; and then it matters not whether the Day of the Month stands in the Margin, or in the Middle of the Page.

Note 4. Write the Name of the Person at the Beginning of the Margin, and then all the Articles delivered, one after another, and the Price per Yard, per Ell, per Cwt. or per lb but you need not cast them up in the Day-book till you come to *post* them: Some Articles indeed have a fixed Price, and then the Money is expressed.

Note 4. In *posting* the Articles of the Day-book into the Ledger, some Persons enter, or make a Line of every Article, or take 2 or 3 Articles together, and *post* them in one Line, according as the Breadth of the Ledger will allow: There can be nothing further said, except this, that Observation and Experience will soon make the Learner perfect.

Note 5. Ditto or Do. signifies the same Thing or Price.

January 1st, 1763.

✓ *John Andrews* 14 lb. of Soap at 5 *d.*
2 lb. of Green Tea at 14 *s.* 2 lb. of Bohea at 6 | 6.
✓ *Thomas Barker*, 1 Piece of Iriſh, 25 Yds. at 2 | 3 per Yd. 12 Yds. of Check at 1 *s.*
✓ *William Batſon*, 12 lb. of Currants at 5 *d* ½.
14 lb. of Raiſins, at 5 *d.* 4 Hats, at 7 | 6
28 lb. of Sugar at 4 *d.* 1 Loaf, 9 lb. at 8 *d.*
✓ *Ann Charlton*, 2 Pieces of black Ribbon, 12 Yds. each, at 5 *d.* 2 ditto white, 10 Yds. each, at 6 *d.* 4 Pieces of ditto flowered, 9 Yds. each, at 7 *d.*
Caſh taken for Sundries in Retail To-day, 5 *l.* 7 *s.* 6 *d* ½.

2d.

✓ *Richard Davies*, 12 lb. of Indico, at 18 *d.*
2 large Lumps of Sugar, 50 lb. at 6 *d.*
4 ſingle Loaves 30 lb. at 8 *d.*
2 double refined 17 ½ lb. at 10 *d.*
✓ *Jonathan Edwards*, 6 Dozen of Braſs Buttons.
6 Dozen of ſcarlet, at 9 *d.*
3 Dozen of ſcarlet Waiſtcoat, 8 *d.*
¼th of blue Velvet, at 16 *s.* per Yard.
Caſh taken To-day for Sundries, 2 *l.* 14 *s.* 7 *d.*

3d.

✓ *Nicholas Forſter*, 3 Gallons of fine Lamp Oil, at 3 *s.* per Gallon, 2 Gallons of Train Oil, at 2 *s.* and a ½ Gallon of Sweet Oil, at 10 *s.* 6 *d.*
✓ *Abraham Gibſon*, Eſq. 2 Quarts of Ketchup, at 2 *s.* 6 *d.* 100 pickled Cucumbers, 15 *d.*
Caſh for Sundries To-day 2 *l.* 4 *s.* 8 *d.*

4th.

✓ *Paul Hewitſon*, 3 Ounces of Nutmegs, at 8 *d.*
5 *lb.* of Indico, at 20 *d.* Ginger, 4 *d.* Pepper, 6 *d.*
✓ *Edward Jackſon*, 14 lb. of Soap at 6 *d* ½.
3 ½ Yards of fine blue grey Cloth, at 18 *s.*
Caſh taken to Day for Sundries 2 *l.* 9 *s.* 6 *d* ¼.

January 5th, 1765.

V *Philip Knapton*, 3 Pieces of Check, *viz.*
17 Yds. at 10*d.*
22 Yds. at 11*d.*
24 Yds. at 13*d.*
16 Ells of Holland, at 4*s.* 9*d.*
4 Yds. of Muſlin at 4*s.* 4*d.*
6 Yds. of Cambrick at 7*s.* 6*d.*
Caſh taken To-day for Sundries, 3*l.* 9*s.*

7th.

V *Charles Longman*, 84 lb. of Raiſins at 38*s* per Cwt.
½ Cwt. of hard Soap, at 2*l.* 5*s.* per Cwt.
2 Quarters of Oil, at 3*s.* per Gallon
1 Pint of ſweet Oil, at 3*s.* per Gallon
1 Pint of ſweet Oil 15*d.*
14 lb. of Rice, at 4*d.*
V *Iſaac Mackie*, Eſq. 1 lb. of Tobacco, 18*d.*
2 Bottles of Ketchup, at 2*s.* 6*d.*
2 lb. of Currants, at 5*d.*
Nutmegs 3 $d\frac{1}{2}$.
2 Quarts of Vinegar 9*d.*
7 lb. of Soap, at $5\frac{1}{2}d.$
2 Dozen of Eggs, at 4*d.*
Caſh taken To-day for Sundries 4*l.* 3*s.* 11*d.*

8th.

V Rev. *Jacob Nelſon*, 2 lb. of Coffee, at 4*s.* 6*d.*
2 Waſh Balls, 10*d.*
1 ld. of beſt Tobacco, at 22*d.*
6 lb. of Raſins at 5*d.*
4 lb of Currants, at $5\frac{1}{2}d.$
V *David Phipps*, 14 lb. of Jar Raiſins, at 7*d.*
2 lb. of Almonds, at 14*d.*
1 Cheſt of Tea, 1 Cwt. 2 qrs. at 30*l.* per Cwt.
Caſh taken To-day for Sundries 7*l.* 3*s.* 8*d.*

Poſted *Jan.*

January 9th, 1765.

V *Andrew Philips*, 2 Baſkets of Malaga Raiſins, 104 lb. at 4*d.*
1 Baſket of Figs, 36 lb. at 7*d.*
4 lb. of Cocoa, at 2*s.* per lb.
40 lb. of Liſbon Sugar, at 6*d.* per lb.
2 Thouſand of Ten-penny Nails, at 5 | 3
V *Robert Raymond*, 2 Gallons of Brandy, at 8*s.*
2 Gallons of Rum, at 9*s.* 6*d.*
2 Gallons of Engliſh Gin, at 4*s.* 6*d.*
2 Gallons of Holland, at 9*s.* 6*d.*
1 Gallon of Anniſeed, at 4*s.* 6*d.*
1 Gallon of Cinnamon Water, at 10*s.* 6*d.*
Caſh taken To-day for Sundries, 2*l.* 17*s.* 10*d.*

10th.

V *Thomas Rogers*, 10[illegible]ed Herrings, at 3*s.* 6*d.*
1 Jar of Linſeed Oil, 4 G[illegible]ons, at 4*s.* 6*d.* per Gallon.
1 Baſket of Raiſins, 50 lb. at 4*d.*
60 Pickled Herrings, 5*s.* 6*d.*
1 qr. Cwt. of Soap, at 2*l.* 10*s.*
V *William Smithe*, Eſqr. 1 Barrel of Anchovies, 3*l.* 5*s.*
2 Bottles of Ketchup, at 2*s.* 6*d.*
14 lb. of Rice, at 5*d.*
Caſh taken for Sundries To-day, 3*l.* 5*s.* 9*d.*

11th.

V *Theophilus Smith*, 2 Pieces of Yard-wide Iriſh, each 25 Yards, at 18*d.*
1 Piece of Dowlas, 28 Yds. at 10*d.*
1 Ditto Ruſſia Cloth, 22 Yds. at 16*d.*
1 Ditto Check, 19 Yds. at 11*d.*
1 Ditto fine, 20 Yds. at 13*d.*
Caſh taken To-day for Sundries, 7*l.* 4*s.*

Poſted *Jan.*

January 12th. 1765.

V Rev. *Charles Smith*, 2 lb. of Chocolate, at 5*s.* 6*d.*
2 lb. of Coffee, at 4*s.*
1 lb. of Hyſon Green, at 14*s.* 6*d.*
1 lb. of Bohea, 9*s.*
1 Loaf of ſingle refined, 12 lb. at 8*d.*
1 ditto double refined 8 lb. at 11*d.*
Caſh taken To-day for Sundries, 2*l.* 17*s.* 11*d.*

14th.

✓ *Jeremiah Thompſon*, 12½ Yds. of Fuſtian, at 2*s.* 3*d.*
2 Dozen of Coat Buttons of the colour, 14*d.*
2 ditto Waiſtcoat and Breeches, at 10*d.*
4 Yds. of Frieze, at 4*s.* 6*d.*
8 Yds. of Shalloon, at 19*d.*
Caſh taken To-day for Sundries, 3*l.* 9*s.* ½.

15th.

✓ *Moſes Walton*, 6 Dozen of Candles, at
1 Piece of Holland, 22 Yds. at 4*s.* 2*d.*
1 ditto Iriſh, 24 Yds. 2*s.* 3*d.*
7 lb. of hard Soap, at 6*d.*
4 lb. of ſoft ditto, at 5*d.*
12 Yards of green Baize, at 16*d.*
Caſh taken To-day for Sundries, 5*l.* 4*s.* 7*d.*

16th.

✓ *Sarah Watſon*, 4 Yds. of black Ribbon, at 5½*d.*
2 Yds. of green, 2 of blue Ribbon, at 6½*d.*
12 Yds. of printed Cotton, 4*s.* 6*d.* per Yd.
¼ lb. of Nutmegs, 2*s.* 6*d.*
Ditto beaten Pepper
6 lb. of Raiſins, at 5*d.*
4 lb. of Currants, at 6*d.*
5 Yds. of Check, at 14*d.*
Caſh taken To-day for Sundries, 3*l.* 19*s.* 7*d.* ½.

Poſted. *January*

January 17th, 1765.

√ *Joſeph Young*, Eſq. 1 lb. of Tea, 14 *s.*
2 lb. of Coffee, at 4 *s.* 6 *d.*
8 lb. of Four-penny Sugar
12 lb. of Five-penny
12 lb. of Raiſins, at 6 *d.*
3 lb. of Almonds, at 10 *d.*
4 lb. of Prunes, at 4 *d* ½.
25 lb. of Malagas, at 4 *d.*
14 lb. of Currants, at 5 *d.*
Nutmegs, Mace, and Cinnamon, 10 *d.*
Caſh taken To-day for Sundries, 7 *l.* 3 *s.*

18th.

√ *John Andrews*, 12 Yds. of Fuſtian, at 3 *s.*
5 Yds. of Shalloon, at 19 *d.*
3 Yds. and ½ of broad blue Cloth, at 18 *s.*
7 Yds. of Check, at 14 *d.*
√ *Thomas Barker*, 3 [illegible]n of Candles, at 6 *s.* 4 *d.*
40 Yds. of Linnen Check for Bed Curtains, at 20 *d.*
14 lb. of Soap, at 7 *d.*
Caſh taken To-day for Sundries, 3 *l.* 4 *s.*

19th.

√ *William Baſton*, 1 Cwt. of Liſbon Sugar, at 2 *l.* 10 *s*
28 lb. of Raiſins, at 5 *d.*
8 lb. of Rice, at 5 *d.*
14 Yards of Ruſſia, at 15 *d.*
Caſh taken To-day for Sundries, 3 *l.* 14 *s.* 9 *d.*

21ſt.

√ *Ann Charlton*, 3 Pieces of blue Ribbon, 25 Yards, at 5 *d.* per Yard.
15 Yards of white coloured ditto, at 5 ½ *d.*
4 Yards of Lace 4|6
19 Yards of coarſe Lace, 2|6
2 Pieces of pink Ribbon, 20 Yards, at 5 *d.*
Caſh taken To-day for Sundries, 2 *l.* 11 *s.*

Poſted. *Jan-*

January 22d, 1765.

✓ *Richard Davies*, 14 lb. of Sugar at 5 *d.*
2 Loaves 17 lb. at 8 *d.*
1 Lump 25 lb. at 7 *d.*
6 lb. of Green Tea, at 12 *s.*
12 lb. of Bohea, at 7 *s.*
Cash taken To-day for Sundries, 3 *l.* 14 *s.*

23d.

✓ *Jonathan Edwards*, 7 Yards of Fustian, at 2|3
9 Yards of blue 7 qr. Cloth, at 18 *s.*
12 Yards of Frieze, at 4|3
8 Yards of Serge, at 4 *s.*
3 Dozen of Brass Buttons, at 20 *d.* per Dozen
3 Dozen of plain blue, at 9 *d.* per Dozen
½ Ounce of blue Silk, 16 *d.*
¾ ditto, of various Colour[illegible]3 *d.*
✓ *Nicholas Forster*, 2 lb. [illegible] 10 *s.* Green Tea
1 lb. at 8 *s.*
✓ *Abraham Gibson*, Esq. 1 lb. of Chocolate, 5|6
1 lb. of Coffee, at 4|6
2 Gallons of Brandy, at 10 *s.* Ditto of Rum, at 10 *s.*
14 Yds. of Holland, at 4|6
Cash taken To-day for Sundries, 6 *l.* 4 *s.* 9 *d.*

24th.

✓ *Paul Hewitson*, 6 Dozen of Candles, at 6|8
14 lb. of Soap, at 6 *d.*
9 Yards of Irish, at 2|3
✓ *Edward Jackson*, 2 Gallons of Brandy, at 7 | 6
1 Gallon of Rum 9 | 6
✓ *Philip Knapton*, 4½ Yards of sky-blue, superfine Cloth, at 19 *s.*
5 Yards of Shalloon, at 22 *d.*
Cash taken To-day for Sundries, 3 *l.* 7 *s.* 7 *d*½.

Posted. Jan-

January 25th, 1765.

√ *Charles Longman*, 1 Piece of Dowlas, 27 Yards, at 14 *d.* per Yard
7 Ells of Holland, at 5 *s.* per Ell.
√ *Iſaac Mackie*, Eſq. 2 lb. of 6 *s.* Bohea
1 lb. of Coffee, at 4|6
½ Dozen Pocket Handkerchiefs, at 19 *d.*
2 red and white ditto, 2|3
√ Rev. *Jacob Nelſon*, 1 lb. of Bohea, 6|6
1 lb. of Green, at 14|6
7 lb. of Salt, 10½ *d.*
2 Ounces of Mace, 18 *d.*
3 lb. of Rice, 9 *d.*
Caſh taken To-day for Sundries, 3 *l.* 19 *s.* 6 *d.*

26th.

√ *David Phipps*, paid a Bill by his Deſire (as per Letter the 15th, Inſtant) to *John Stow*, Wine Merchant, 5 *l.* 8 *s.* 3 *d.*
10 Yards of flowered Cotton for his Daughter, at 3 | 6
6 Yards of Check, at 13 *d.*
√ *Andrew Philips*, 14 Yards of Pluſh, at 5 | 6
2 Dozen of Coat Buttons, at 14 *d.* per Dozen.
1 green Velvet Cap, 7 *s.* 6 *d.*
Caſh taken To-day for Sundries, 2 *l.* 15 *s.*

28th.

√ *Robert Raymond*, 4 Gallons of Brandy, at 8 *s.*
2 Gallons of Rum, at 9 | 6
1 Gallon of Holland Gin, 9 | 6
1 Gallon of beſt Engliſh Gin, 5 | 6
2 Dozen of red Port, at 22 *s.* per Dozen.
Caſh taken To-day for Sundries, 5 *l.* 3 *s.*

29th.

√ *Thomas Rogers*, 7 Ells of Holland, at 4 | 6
Two Pieces of Cambrick 8 Yards each, at 9 *s.*
Ditto Muſlin 5 Yards each, at 4 | 6
12 Yards of Fuſtian, at 2 | 3
4 Yards of Baize, at 16 *d.*
√ *Jeremiah Thompſon*, 4 Dozen of red Port, at 22 s. per Dozen.
6 Dozen of Mountain, at 25 *s.* per Dozen
2 Dozen of Madeira, at 30

Poſted. *Jan-*

January 30th, 1765.

√ *William Smith*, Esq. 2 Bottles of Ketchup at 2 | 9
1 Gallon of Vinegar, 2 | 8
14 lb. of Soap, at 6 *d.*
√ *Theophilus Smith*, 12 China Cups and Saucers, 14 *s.*
1 China Tea-pot, 5 | 6
4 Dozen of white Stone Plates, at 3 | 6
√ Rev. *Charles Smyth*, 2 lb. of Coffee, at 4 | 3
1 lb. of Bohea Tea, 6 | 6
1 lb. of Green ditto, 12 | 6

31ſt.

√ *Moſes Walton*, 14 lb. of Smyrnas, at 4 *d.* ½.
12 lb. of Currants, at 5 *d.*
8 lb. of Tobacco, at 18 *d.*
6 lb. of ditto, at 1 *s.*
√ *Sarah Watſon*, 3 Pieces of black Ribbon, viz.
No. 1 —— 12 Yds.
2 —— 14 Yds. } at 4 *d.* ½.
3 —— 15 Yds.
1 Piece of white 10 Yards, at 6 *d.* ½
1 ditto blue, 12 Yards, at [illegible] *d.*
1 ditto green, 11 Yards, at 7 *d.*
1 ditto pink, 9 Yds. at 6 *d.* ½.
Joſeph Young, Esq. 1 Piece of Holland, 20 Yds. at 5 | 3
4 lb. of Cocoa, at 4 | 3
2 lb. of green Tea, at 14 *s.*
3 lb. of ditto, at 12 *s.*
4 lb. of Bohea, at 7 *s.* 6 *d.*
2 Gallons of Shrub, at 11 *s.*
2 ditto of Rum, at 10 *s.*
2 ditto Brandy, at 9 *s.*
3 Dozen of Glaſſes, at 4 | 6
A 2 Quart double Flint Decanter, 5 *s.*
1 of a Quart ditto, 3 *s.*
2 large Flint Tumblers, 2 | 6
10 Yards of Haircloth, at 14 *d.*
12 Yards of Matting, at 15 *d.* *Poſted.*

N. B. Theſe Articles are all ſeparately poſted or entered into the Ledger, except the laſt Article, viz. Caſh taken To-day for Sundries, which is omitted, as it is only by Way of Memorandum to put us in Mind what is daily taken, ſo that any Perſon may make a private Caſh-Book to his own liking of all he pays or receives.

OF

OF THE

LEDGER.

1. THE Ledger is the Day-Book taken to Pieces and digeſted in a proper Manner, having every Man's particular Accompt of his Debt entered or poſted on the left Hand Side thereof, Word for Word, with the ſaid Day Book, and with this Addition, that the Money, or whole Debt, is here inſerted in three Columns containing Pounds, Shillings, and Pence.

2. In large Accompts of Merchandiſe indeed, the Ledger has 4 Columns; in the firſt of which is marked the Page of the *Journal* or Day Book; but as there is here no Journal or Caſh Book, only a plain ſimple Diary, there is no Occaſion for Pages of Reference, the Day of the Month being fully ſufficient for that Purpoſe.

3. As there is therefore no Occaſion for a Journal, in ſuch ſimple Accompts as theſe; ſo there cannot be any Neceſſity for a regular Caſh Book, or a ſeparate Accompt of Caſh and Stock being Debtor or Creditor to each other, as muſt neceſſarily be the Caſe in all extenſive Trades or mercantile Buſineſs.

4. Therefore as there is here no regular Caſh Book, when any Perſon pays you Money that deals with you in an open Accompt in the Ledger, you muſt take Care to turn to the Ledger, and enter it forthwith on the Creditor's, or right hand Side, and then no Miſtake can be made. The ſame muſt be done when you receive any Goods on Accompt: ſeveral Examples of theſe you may ſee in the Ledger, Pages, 2, 3, 6, 8, and 10th, *&c.*

5. If an Accompt is diſcharged at one Payment, enter it as in Page 3, *Nicholas Forſter*, or Page 4, *Paul Hewitſon*, and ſay, By Caſh in full.

6. When it happens that a Perſon reckons with you, and does not pay the Balance of the Accompt that you then ſettle; never let the old Accompt ſtand uncloſed, but balance it properly (whether it be ſettled without his giving you a Note, or whether he gives you a Note, which no doubt is beſt) by taking the Balance due from him to you on the Creditor's Side, and removing it by opening a freſh Accompt on the Debtor's ſide. Thus you ſee, Folio 1, in the Accompt of *Thomas Barker*, that *April* the 7th, he left three Guineas due in the Balance, and gave a Note of Hand to pay it in a Month; the Note accordingly is entered on the Creditor's Side in order to balance the Accompt; but then it is at the ſame Time brought to the Debtor's Side to ſhew he is ſtill Debtor. Then *May* the 10th, you ſee the ſaid Note is paid, and a full Balance ſtruck between Parties, the Note being given up.

Thus it appears, that all Affairs of common Buſineſs (not large mercantile Accompts) may be kept regular by Care and ſingle Entry only.

7. As for a Caſh Book, any Perſon may keep an Accompt of what he pays and receives without any Difficulty, if there be but an honeſt Deſign and good Reſolution.

8. The *Alphabet* is a Liſt of the Names of all ſuch Perſons as you have an open and conſtant Account with, and it is formed or made alphabetically, by putting the Surname of the Perſons firſt under the Letter of the Alphabet it begins with, and then the Chriſtian Name after it, and in the Column oppoſite to the Name, is the Folio of the Ledger the Accompt ſtands in, as follows.

The ALPHABET.

1765.	*John Andrews, Dr.*	l.	s.	d.
Jan. 1	To 14 lb. of Soap, at 5 *d.* - -	0	5	10
	To 2 lb. of green Tea, at 14 *s.* per lb.	1	8	0
	To 2 lb. of Bohea, at 6 | 6 -	0	13	0
18	To 12 Yds. of Fuſtian, at 3 *s.*	1	16	0
	To 5 Yds. of Shalloon, at 19 *d.*	0	7	11
	To 3 ½ Yds. of blue Broad Cloth, at 18 *s.* - - - - - -	3	3	0
	To 7 Yds. of Check, at 14 *d.*	0	8	2
		8	1	11

1765.	*Thomas Barker, Dr.*			
Jan. 1	To 1 Piece of Iriſh 25 Yds. at 2 | 3	2	16	3
-	To 12 Yds. of Check, at 1 *s.*	0	12	0
18	To 3 Dozen of Candles, at 6 | 4	0	19	0
	To 40 Yds. of Check, for Bed Curtains, at 20 *d.* - - -	3	6	8
	To 14 lb. of Soap, at 7 *d.* - -	0	8	2
		8	2	1
April 7	To a Note of Hand, due May 7, as per Contract - - - - -	3	3	0
-	N. B. Here you ſee the 3 Guineas Balance on the Creditor's Side, is brought to a freſh Accompt, and made Debtor on this Side.			

1765.	*Contra Cr.*	l.	s.	d.
Jan. 17	By Cash by *Hobb* the Carrier -	1	1	0
March 7	By 1 Chaldron of Coals -	1	7	0
April 14	By a Load of Wood - -	0	14	0
25	By Cash to Balance, received	4	19	11
		8	1	11

1765.	*Contra Cr.*			
Feb. 14.	By Cash of his Servant - -	2	2	0
19	By Hay and Straw - - - -	0	15	1
March 3	By Cash - - - - -	2	2	0
April 7	By a Note of Hand received for one Month carried to Debtor's Side	3	3	0
		8	2	1
May 10	By Cash in full of said Note	3	3	0

1765.	*William Batſon*, Dr.	l.	s.	d.
Jan. 1	To 12 lb. of Currants, at 5 *d.* ½	0	5	6
	To 14 lb. of Raiſins, at 5 *d.* -	0	5	10
	To 4 Hats, 7 | 6 each - -	1	10	0
	To 28 lb. of Sugar, at 4 *d.* -	0	9	4
	To 1 Loaf of ditto, 9 lb. at 8 *d.*	0	6	0
19	To 1 Cwt. of Liſbon Sugar, -	2	10	0
	To 28 lb. of Raiſins, at 5 *d.* -	0	11	8
	To 8 lb. of Rice, at 5 *d.* - -	0	3	4
	To 14 Yds. of Ruſſia, at 15 *d.*	0	17	6
		6	19	2

1765.	*Ann Charlton*, Dr.			
Jan. 1	To 2 Pieces of black Ribbon 17 Yds. each, at 5 *d.* per Yard	0	10	0
	To 2 ditto white 10 yds. each, at 6 *d.*	0	10	0
	To 4 ditto flowered, 9 Yds. each, 36 Yds, at 7 *d.* - -	1	1	0
21	To 3 Pieces of blue Ribbon, 25 Yds. at 5 *d.* - -	0	10	5
	To 1 ditto 15 Yds. white flowered, at 5 *d.* ½. - - -	0	6	10½
	To 4 Yds. of Lace, at 4|6 -	0	18	0
	To 9 Yds. of ditto, at 2 *s.* 6 *d.* -	2	7	6
	To 2 Pieces pink Ribbon, 20 ys. 5 *d.*	0	8	4
		6	12	1½

1765.	*Richard Davis*, Dr.			
Jan. 2	To 12 lb. of Indico, at 18 *d.* -	0	18	0
	To 2 Lumps of Sugar, 50 lb at 6 *d.*	1	5	0
	To 4 ſingle refin'd Loaves, 30 lb. 8 *d*	1	0	0
	To 2 double refin'd 17 lb. ½, at 10 *d*	0	14	7
22	To 14 lb. of Sugar, at 5 *d.* - -	0	5	10
	To 2 Loaves ditto, 17 lb. at 8 *d.*	0	11	4
	To 1 Lump 25 lb. at 7 *d.*	0	14	7
	To 6 lb. of green Tea, at 12 *s.*	3	12	0
	To 12 lb. of Bohea, at 7 *s.* -	4	4	0
		13	5	4

1765.	*Contra Cr.*	l.	s.	d.
Feb. 21	By Cash received of him - -	2	12	6
March 7	By a Side of Pork 63 lb. at 5 *d.* -	1	6	3
27	By Balance received - -	3	0	0
		6	19	2

1665.	*Contra Cr.*			
Feb. 18	By Cash of your Servant - -	1	1	0
March 14	By Cash in full - - -	5	11	1½
		6	12	1½

1765.	*Contra Cr.*			
Jan. 12	By Cash received of Mrs. *Davis*	2	2	0
17	By 1 Load of Hay - -	2	5	0
April 4	By Cash - - -	1	11	6
17	By Cash to Balance - -	7	6	10
		13	5	4

1765.	*Jonathan Edwards, Dr.*	l.	s.	d.
Jan. 2	To 6 Dozen of Braſs Buttons, 6 Doz. of ſcarlet, at 9*d.* per Doz.	0	9	0
	To 3 Dozen of ditto, for Waiſtcoats, at 8*d.* - - -	0	2	0
	To ⅛ of blue Velvet, at 16*s.* a Yd.	0	2	0
	To 7 Yds. of Fuſtian, at 2 | 3	0	15	9
23	To 9 Yds. of fine blue 7 qr. Cloth, at 18*s.* - - -	8	2	0
	To 12 Yds. of Frieze, at 4 | 3	2	11	0
	To 8 Yds. of Serge, at 4*s.* - -	1	12	0
	To 3 Doz. Braſs Buttons, at 20*d.*	0	5	0
	To 3 ditto plain blue, at 9*d.* -	0	2	3
	To ½ oz. of blue Silk - -	0	1	4
	To ½ oz. of various Colours ditto	0	1	3
		14	3	7

1765.	*Nicholas Forſter, Dr.*			
Jan. 3	To 3 Gallons of fine Lamp Oil, at 3*s.* per Gallon - -	0	9	0
	To 2 Gallons of Train Oil, at 2*s.*	0	4	0
	To ½ Gallon ſweet Oil, at 10*s.* 6*d.*	0	5	3
23	To 2 lb. of 10*s.* green Tea - -	1	0	0
	To 1 lb. of 8*s.* ditto - - -	0	8	0
		2	6	3

1765.	*Abraham Gibſon, Eſq; Dr.*			
Jan. 3	To 2 Quarts of Ketchup, at 2 | 6	0	5	0
	To 100 of pickled Cucumbers, -	0	1	3
	To 1 lb. of Chocolate - -	0	5	6
	To 1 lb. of Coffee - -	0	4	6
23	To 2 Gallons of Brandy, at 10*s.*	1	0	0
	To ditto Rum, 11*s.* - -	1	2	0
	To 14 Yds. of Holland, at 4*s.* 6*d.*	3	3	0
		6	1	3

Contra, Cr.

1765.		l.	s.	d.
Feb. 5.	By a Bill received - - -	2	17	0
	Making me a Suit of Clothes, Silk, Twist, &c. - - -	5	5	0
21	By a Pair of new Stays for my Wife	1	16	0
	By ditto for my daughter - -	1	10	0
March 9	By a whole Suit of Fuſtian for Son, and making, as per Bill - -	2	4	6
	By Caſh in full - - -	0	11	1
		14	3	7

Contra Cr.

1765.		l.	s.	d.
March 9	By Caſh received in full - -	2	6	3
		2	6	3

Contra Cr.

1765.		l.	s.	d.
March 3	By a Note on *Martin Drake*, received of him - -	5	0	0
29	By Caſh in full - - -	1	1	3
		6	1	3

1765.		*Paul Hewitſon, Dr.*	l.	s.	d.
Jan.	4	To 3 Oz. of Nutmegs, at 8 *d.*	0	2	0
		To 5 lb. of Indico, at 20 *d.* -	0	8	4
		To Ginger 4 *d.* Pepper 6 *d.* -	0	0	10
	24	To 6 Dozen of Candles, at 6 | 8	2	0	0
		To 14 lb. of Soap, at 6 *d.* - -	0	7	0
		To 9 Yds. of Iriſh, at 2 *s.* 3 *d.*	1	0	3
		- - -			
			3	18	5

1765.		*Edward Jackſon, Dr.*			
Jan.	4	To 14 lb. of Soap, at 6 *d.* ½. -	0	7	1
		To 3 ½ Yds. of ſuperfine blue Cloth, at 18 *s.* - -	3	3	0
	24	To 2 Gallons of Brandy, at 7|6	0	15	0
		To 2 ditto Rum - - -	0	9	6
		- -			
			4	15	1

1765.		*Philip Knapton, Dr.*			
Jan.	5	To 3 Pieces of Check, *viz.*			
		17 Yds, at 10 *d.* - - -	0	14	2
		22 Yds. at 11 *d.* - -	1	0	2
		24 Yds. at 13 *d.* - -	1	6	0
		To 16 Ells of Holland, at 4 *s.* 9 *d.*	3	16	0
		To 4 Yds. of Muſlin, at 4 | 4	0	17	4
		To 6 Yds. of Cambrick, at 7 | 6	2	5	0
	24	To 4¼ yds. ſuperfine blue cloth 19 *s.*	4	5	6
		To 5 Yds. white Shalloon, at 22 *d.*	0	9	2
			14	13	4

1765.	*Contra Gr.*	l.	s.	d.
April 5	By Caſh in full - - -	3	18	5
		3	18	5

1765.	*Contra Cr.*			
Feb. 20	By Caſh on Account - -	3	8	0
May 3	By 3 Buſhels of Malt, at 4 | 4	0	13	0
29	By Caſh in full - - -	0	14	1
		4	15	1

1765.	*Contra Cr.*			
Feb. 13	By Caſh himſelf - - -	3	3	0
Mach. 11	Ditto by his Servant - -	5	5	0
April 9	By Caſh in full - - -	6	5	4
		14	13	4

1765.	*Charles Longman, Dr.*	l.	s.	d.
Jan. 6	To 3 qrs. of cwt. of Raiſins, at 1 *l.* 18 *s.* per cwt. - -	1	8	6
	To ½ cwt. of Soap, at 2 *l.* 5 *s.* -	1	2	6
	To 2 Quarts Oil, at 3 *s.* per Gall.	0	1	6
	To 1 Pint of ſweet Oil - - -	0	1	3
	To 14 lb. of Rice, at 4 *d.* - -	0	4	8
25	To 1 Piece of Dowlas 27 Yds. 14 *d.*	1	11	6
	To 7 Ells of Holland, at 5 *s.* -	1	15	0
		6	4	11

1765.	*Iſaac Mackie, Eſq; Dr.*			
Jan. 7	To 1 lb. of Tobacco - -	0	1	6
	To 2 Bottles of Ketchup, at 2 | 6	0	5	0
	To 2 lb. of Currants, at 5 *d.* -	0	0	10
	To Nutmegs 3½*d.* and Vinegar 9 *d.*	0	1	0½
	To 7 lb. of Soap, at 5 *d.* ½. -	0	3	2½
	To 2 Dozen of Eggs, at 4 *d.* -	0	0	8
25	To 2 lb. of 6 *s.* Bohea Tea -	0	12	0
	To 1 lb. of Coffee - -	0	4	6
	To half Dozen Pocket Handkerchiefs, at 19 *d.* - -	0	9	6
	To 2 ditto red and white, at 2 | 3	0	4	6
		2	2	9

1765.	*Rev. Jacob Nelſon, Dr.*			
Jan. 8	To 2 lb. of Coffee, at 4 | 6 -	0	9	0
	To 2 Waſh Balls - -	0	0	10
	To 1 lb. of beſt Tobacco - -	0	1	10
	To 6 lb. of Raiſins, at 5 *d.* -	0	2	6
	To 4 lb. of Currants, at 5 *d.* ½. -	0	1	10
25	To 1 lb. of Bohea - -	0	6	6
	To 1 lb. of green Tea - -	0	14	6
	To 7 lb. of Salt - - -	0	0	10½
	To 2 oz. of Mace, at 9 *d.* - -	0	1	6
	To 3 lb. of Rice - -	0	0	9
		2	0	1½

1765.	*Contra Cr.*	l.	s.	d.
Feb. 15.	By Caſh received - -	1	1	0
March 14	By ditto - - - - - - -	1	1	0
29	By ditto in full - - - - -	4	2	11
		6	4	11

1765.	*Contra Cr.*			
Apr. 5.	By Caſh received - - - -	2	2	9
		2	2	9

1765.	*Contra Cr.*			
	By Tithes due at Chriſtmas laſt	1	0	0
May 27	By Caſh received of him in full	1	0	1½
		2	0	1½

1765.	*David Phipps, Dr.*	l.	s.	d.
Jan. 8	To 14 lb. of Jar Raiſins, at 7 *d.*	0	8	2
	To 2 lb. of Almonds, at 14 *d.*	0	2	4
	To 1 cheſt of Tea, 1 cwt. 2 qrs. at 30 *l.* per Cwt. - - - -	45	0	0
26	To a Bill Caſh paid by his Order (dated 15th Inſtant) to J. Stowe, Wine Merchant - - - -	5	8	3
	To 10 Yds. of flower'd Cotton, for his Daughter, at 3 *s.* 6 *d.* per Yd.	1	15	0
	To 6 Yds. of Check, at 13 *d.*	0	6	6
		53	0	3

1765.	*Andrew Phillips, Dr.*			
Jan. 9	To 2 Baſkets of Malagas, 104 lb. 4 *d.*	1	14	8
	To a Baſket of Figs, 36 lb. at 7 *d.*	1	1	0
	To 4 lb. of Cocoa, at 2 *s.* - -	0	8	0
	To 40 lb. of Liſbon Sugar, at 6 *d.*	1	0	0
	To 2000 of 10 *d.* Nails at 5 *s.* 3 *d.*	0	10	6
26	To 14 Yds. of Pluſh, at 5 *s.* 6 *d*	3	17	0
	To 2 Doz. of Coat Buttons, 14 *d.*	0	2	4
	To a green Velvet Cap - -	0	7	6
		9	1	0

1765.	*Robert Raymond, Dr.*			
Jan. 9	To 2 Gallons of Brandy, at 8 *s.*	0	16	0
	To 2 Gallons of Rum, at 9 | 6	0	19	0
	To 2 ditto Engliſh Gin, at 4 | 6	0	9	0
	To 2 ditto Hollands, at 9 | 6 -	0	19	0
	To 1 Gallon of Anniſeed, at 4 | 6	0	4	6
28	To 1 Gall. of Cinnamon, at 10 | 6	0	10	6
	To 4 Gallons of Brandy, at 8 *s.*	1	12	0
	To 2 Gallons of Rum, at 9 | 6	0	19	0
	To 1 ditto Holland Gin - -	0	9	6
	To 1 Gallon of beſt Engliſh ditto	0	5	6
	To 2 Dozen of red Port, at 22 *s.*	2	4	0
		9	8	0

1765.	*Contra Cr.*	l.	s.	d.
Feb. 7	By Cash received of himself -	21	0	0
March 11	By a Bank Note, K No. 241 -	20	0	0
April 25	By 6 Yds. of Lace, 5 | 6 - -	1	13	0
	By 3 Yds. of ditto, at 10 | 6 -	1	11	6
May 7	By Cash in full - -	8	15	9
		53	0	3

1765.	*Contra Cr.*	l.	s.	d.
Feb. 23	By Cash received - -	2	12	6
March 5	By 8 Bushels of Malt, at 4 *s.*	1	12	0
April 7	By Cash in full - - -	4	16	6
		9	1	0

1765.	*Contra Cr.*	l.	s.	d.
Feb. 27	By Cash of himself received -	2	2	0
March 4	By a Turkey - - -	0	5	8
	By 8 lb. of Bacon, at 8 *d.* -	0	5	4
17	By Cash in full - - -	6	15	
		9	8	0

1765.	*Thomas Rogers, Dr.*	l.	s	d.
Jan. 10	To 100 of Red Herrings - -	0	3	6
	To 1 Jar linseed Oil, 4 Galls. 4|6	0	18	0
	To 1 Basket of Raisins, 50 lb. 4*d.*	0	16	8
	To 60 pickled Herrings - -	0	5	6
	To ¼ Cwt. of Soap, at 2*l.* 10*s.*	0	12	6
29	To 7 Ells of Holland, at 4*s.* 6*d.*	1	11	6
	To 2 Pieces of Cambrick, 8 Yds. each, at 9*s.* - - -	7	4	0
	To ditto Muslin, 5 Yds. each at 4|6	2	5	0
	To 12 Yds. of Fustian, at 2 | 3	1	7	0
	To 4 Yds. of Baize, at 16*d.* -	0	5	4
		15	9	0

1765.	*William Smyth, Esq; Dr.*			
Jan. 10	To 1 Barrel of Anchovies - -	3	5	0
	To 2 Bottles of Ketchup, at 2 | 6	0	5	0
	To 14 lb. of Rice, at 5 *d.* - -	0	5	10
	To 2 Bottles of Ketchup, at 2 | 9	0	5	6
	To 1 Gallon of Vinegar - -	0	2	8
	To 14 lb. of Soap, at 6 *d.* - -	0	7	0
		4	11	0

1765.	*Theophilus Smith, Dr.*			
Jan. 11	To 2 Pieces of Irish, each 25 yds. 18*d.*	3	15	0
	To 1 ditto of Dowlas, 28 Yds. 10*d.*	1	3	4
	To 1 ditto Russia, 22 Yds. at 16*d.*	1	9	4
	To 1 ditto Check, 19 Yds. at 11 *d.*	0	17	5
	To 1 ditto fine ditto, 20 Yds. 13 *d*	1	1	8
	To 12 China Cups and Saucers	0	14	0
30	To a China Tea Pot - - -	0	5	6
	To 4 Dozen of Stone Plates, at 3|6	0	14	0
		10	0	3

1765.	*Contra Cr.*	l.	s.	d.
March 19	By Cash received - - -	2	12	6
27	By a Bill on *John Davis*, received	10	4	0
April 5	By Cash to Balance, received	2	12	6
		15	9	0

1765.	*Contra Cr.*			
Feb. 25	By Cash received - -	2	1	0
March 4	By ditto - - - -	1	2	0
April 27	By ditto - - -	1	8	0
		4	11	0

1765.	*Contra Cr.*			
Feb. 5	By Cash - - - -	5	5	0
April 6	By a Side of Pork, 14 lb. at 6 *d.* ½.	0	7	7
	By 2 Gallons of Port, at 12*s.*	1	4	0
May 4	By Cash in full - - -	3	3	8
		10	0	3

1765.	*Rev. Charles Smyth, Dr.*	l.	s.	d.
Jan. 12	To 2 lb. of Chocolate, at 5 | 6	0	11	0
	To 2 lb. of Coffee, at 4*s.* - -	0	8	0
	To 1 lb. of Hyſon Tea - -	0	14	6
	To 1 lb. of Bohea - -	0	9	0
	To 1 Loaf of ſingle refined, 12 lb. 8*d.*	0	8	0
	To 1 ditto double refined, 8 lb. 11*d.*	0	7	4
30	To 2 lb. of Coffee, at 4 | 3 -	0	8	6
	To 1 lb. of Bohea Tea - -	0	6	6
	To 1 lb. of Green ditto - -	0	12	6
		4	5	4

1765.	*Jeremiah Thompſon, Dr.*			
Jan. 14	To 12 ½ Yds. of Fuſtian, at 2 | 3	1	8	1½
	To 2 Doz. Coat Buttons, at 14*d.*	0	2	4
	To ditto Waiſtcoat, at 10*d.* -	0	1	8
	To 4 Yds. of Freeze, at 4 | 6	0	18	0
	To 8 Yds. of Shalloon, at 19*d.*	0	12	8
29	To 4 Doz. red Port, 22*s.* per doz.	4	8	0
	To 6 Doz. Mountain, 25*s.* per doz.	7	10	0
	To 2 Doz. of Madeira, at 30*s.*	3	0	0
		18	0	9¾

1765.	*Contra Cr.*	l.	s.	d.
Feb. 5	By ſmall Tithes, 1 Year's Agreement to Chriſtmas - - -	2	2	0
Mar. 27	By Caſh received in full - - -	2	3	4
		4	5	4

1765.	*Contra Cr.*			
Mar. 16	By a Side of Hampſhire Bacon, 114 lb. at 5*d.* - -	2	7	6
27	By 4 Groſs of Bottles, at 1*l.* 10*s.* per Groſs - -	6	0	0
April 9	By a large Looking-Glaſs gilt -	8	8	0
May 15	By Caſh in full - - -	1	5	$3\frac{1}{2}$
		18	0	$9\frac{1}{2}$

1765.	*Moſes Walton, Dr.*	l.	s.	d.
Jan. 15	To 6 Dozen of Candles, at 6 | 4	1	18	0
	To 1 Piece of Holland, 22 Yds. 4 | 2	4	11	8
	To 1 ditto Iriſh, 24 Yds. 2 | 3	2	14	0
	To 7 lb. of hard Soap, at 6 *d.* -	0	3	6
	To 4 lb. of ſoft, at 5 *d.* - -	0	1	8
	To 12 Yds. of green Baize, 16 *d.*	0	16	0
31	To 14 lb. of Smyrnas, at 4 ½ -	0	5	3
	To 12 lb. of Currants, at 5 *d.* -	0	5	0
	To 8 lb. of Tobacco, at 18 *d.* -	0	12	0
	To 6 lb. of ditto, at 1 *s.* - -	0	6	0
		11	13	1

1765.	*Sarah Watſon, Dr.*			
Jan. 16	To 4 Yds. of black Ribbon, 5 *d.* ½.	0	1	10
	To 2 Yds. of green, and 2 Yds. of blue, at 6 *d.* ½. - - -	0	2	2
	To 12 Yds. of printed Cotton, 4 | 6	2	14	0
	To ¼ lb. of Nutmegs - -	0	2	6
	To ½ lb. of Pepper - -	0	0	6
	To 6 lb. of Raiſins, at 5 *d.* -	0	2	6
	To 5 Yds. of Check, at 14 *d.* -	0	5	10
31	To 3 Pieces of black Ribbon, viz.			
	No. 1 — 12 Yds. } at 4 *d.* ½.	0	4	6
	2 — 14 Yds. } at 4 *d.* ½.	0	5	3
	3 — 15 Yds. } at 4 *d.* ½.	0	5	7½
	To 1 Piece of white 10 Yards, 6 *d.* ½.	0	5	5
	To 1 ditto blue, 12 Yards, at 6 *d.*	0	6	0
	To 1 ditto green, 11 Yds. at 7 *d.*	0	6	5
	To 1 ditto pink, 9 Yds. at 6 *d.* ½.	0	4	10½
		5	7	5

1765.	*Contra Cr.*	l.	s.	d.
March 5	By Cash received - - -	2	2	0
17	By 4 Cwt. of Tallow, at 1 *l.* 17 *s.* 4 *d.* per Cwt. - - -	7	9	4
April 14	By Cash in full - - -	2	1	9
		11	13	1

1765.	*Contra Cr.*			
April 5	By Cash - - -	3	3	0
16	By a black Silk Bonnet - -	0	7	6
19	By a green Silk Hat - -	0	6	6
May 5	By Cash in full - -	1	10	5
		5	7	5

1765.	*Joseph Young, Esq;*	l.	s.	d.
Jan. 17	To 1 lb. of Tea, at 14*s.* - -	0	14	0
	To 2 lb. of Coffee, at 4 | 6 -	0	9	0
	To 8 lb. of Sugar, at 4*d.* - -	0	2	8
	To 12 lb. at 5*d.* - -	0	5	0
	To 12 lb. of Raisins, at 6*d.* -	0	6	0
	To 3 lb. of Almonds, at 10*d.* -	0	2	6
	To 4 lb. of Prunes, at 4$d\frac{1}{2}$. -	0	1	6
	To 25 lb. of Malagas, at 4*d.* -	0	8	4
	To 14 lb. of Currants, at 5*d.* -	0	5	10
	To Mace, Cinnamon, & Nutmegs	0	0	10
31	To 1 Piece of Holland, 20 Yds. 5|3	5	5	0
	To 4 lb. of Cocoa, at 4 | 3 - -	0	17	0
	To 2 lb. of green Tea, at 14*s.*	1	8	0
	To 3 lb. of ditto, at 12*s.* - -	1	16	0
	To 4 lb. of Bohea, at 7*s.* 6*d.* -	1	10	0
	To 2 Gallons of Shrub, at 11*s.*	1	2	0
	To 2 ditto of Rum, at 10*s.* -	1	0	0
	To 2 ditto of Brandy, at 9*s.* -	0	18	0
	To 3 Dozen of Glasses, at 4 | 6	0	13	6
	To a two Quart double Flint Decanter, - - -	0	5	0
	To 1 of a Quart ditto, - -	0	3	0
	To 2 large Flint Tumblers, - -	0	2	6
	To 10 Yards of Haircloth, at 14*d.*	0	11	4
	To 12 Yards of Matting, at 15*d.*	0	17	0
		19	4	4

1765.	*Contra Cr.*	l.	s.	d
Feb. 14	By Cash received by his Footman	5	5	0
19	By a Hogshead of Cyder - -	4	14	6
Mar 25	By Cash received of the Carrier	2	2	0
Apr. 14	By ditto of his Footman - -	3	3	0
17	By a Load of Wood - -	0	10	6
27	By a Load of Stack Wood - -	0	14	0
Mar 6	By Cash received in full - -	2	15	4
		19	4	4

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